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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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THE GARDEN BARROW: HOW TO MAKE IT.

BY WHEELER.

IN making the body of a garden barrow we shall be able to buy our stuff ready sawn out to commence work with from any English timber dealer—*i.e.*, one who deals in nothing but English-grown wood. I have both bought planking and sawn up the stuff, and also bought it ready sawn from the dealers, and I find from experience that it is cheaper in the end to buy the stuff ready sawn. A list of the pieces which will be required in making the barrow body are enumerated below, namely, one pair of ash shafts, one pair of elm legs, one oak or ash top piece, one pair of front standards, one pair of oak slots, two pairs of ash side standards; also boarding for the barrow. This can be of birch or elm, or, failing these, we can get a spruce deal board, 11 in. wide, 1 in. thick.

When picking your stuff, be sure that it is well seasoned. As is usually the case, the pieces will be a little longer than required. This is on account of the different lengths of different barrows. In planing the above-mentioned pieces, always get two sides of a piece true, to work from. The squared sides should be marked, to enable us to see it at a glance; and, when setting the work out, to always have the true sides at the top and outer side. In wheelwrighting this is the general rule. Before we commence to plane our shafts or strines we saw them to the required length, which will be 56 in. or 60 in. long, 3 in. by 2 in. thick when planed. We next get our slots or swords. These will be $2\frac{1}{2}$ in., $1\frac{1}{4}$ in. thick, 22 in. long. Of course, these will be too long, but we do not saw them off now, but after they have been fitted. After these have been planed, we set our shafts upon a pair of joiner's trestles, and set them out with a long straightedge.

Now, this setting the framework out right is very tedious work, but it has to be done, and done properly, or, if not, the barrow will be, when finished, askew. The most effectual and easiest way I know of is to place the shafts upon a fairly level floor, letting one end of the shafts touch the skirting board or the wall. Now the shafts have two ends; one is called the wheel end and the other the handle end. It is the wheel end which will touch the wall. Get hold of the handle ends and draw them apart until you can measure $26\frac{1}{2}$ in. across the shafts at the handle ends, outside measurement. At the wheel end measure across the top $12\frac{1}{2}$ in., the measurements in both cases to be from outside to outside top edge of the shafts. We now place our slots upon the top. Measure from the front of the slot to the end

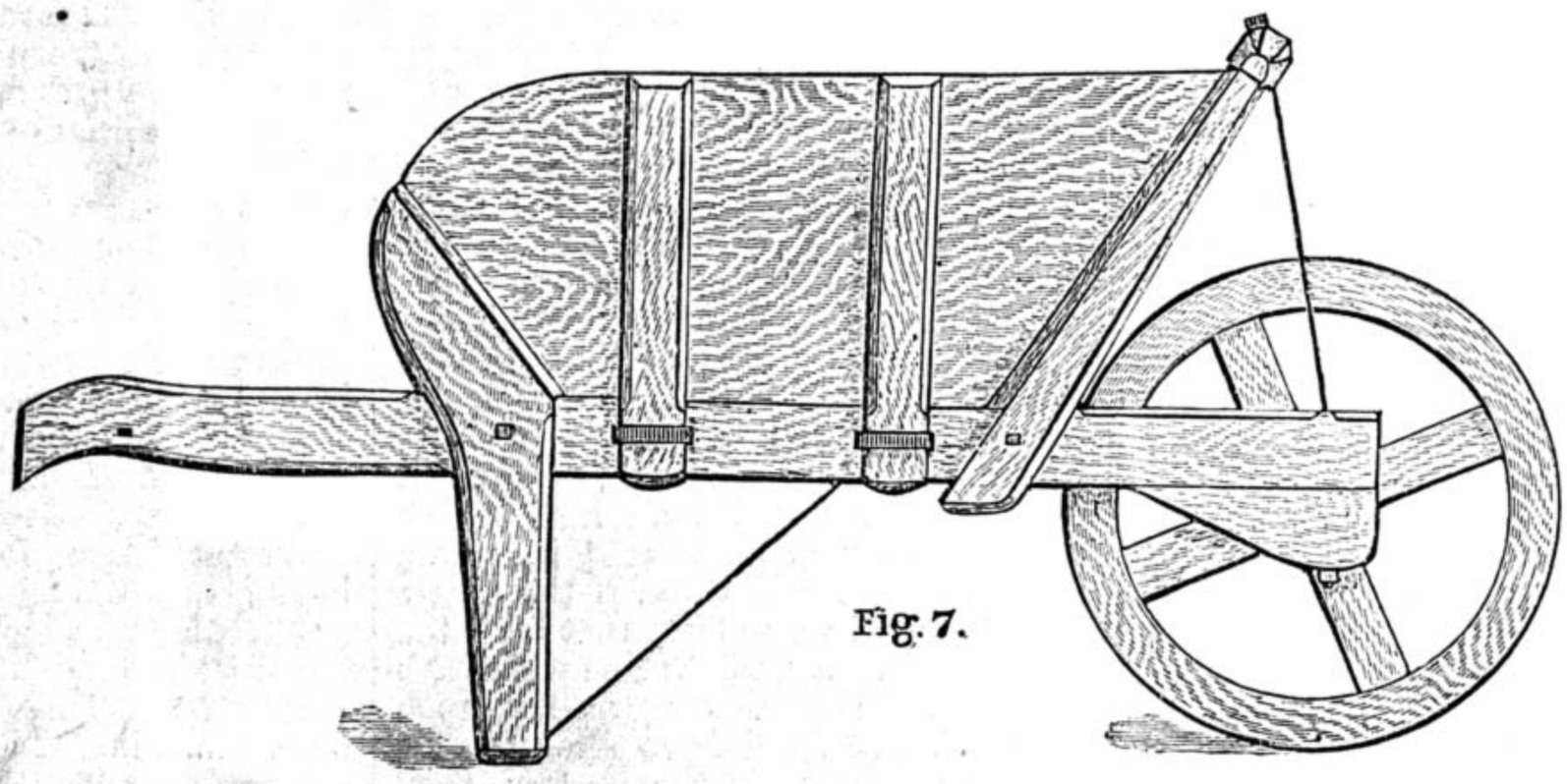

Fig. 7.

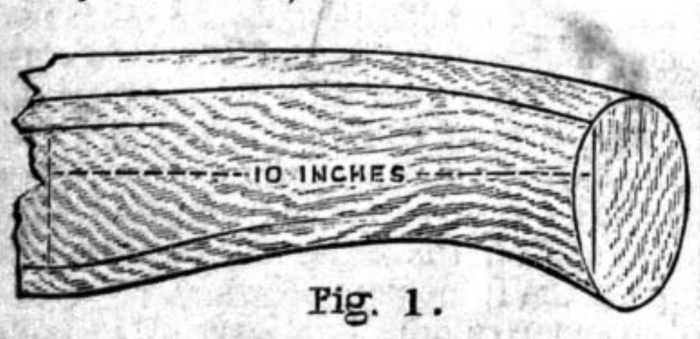

Fig. 1.

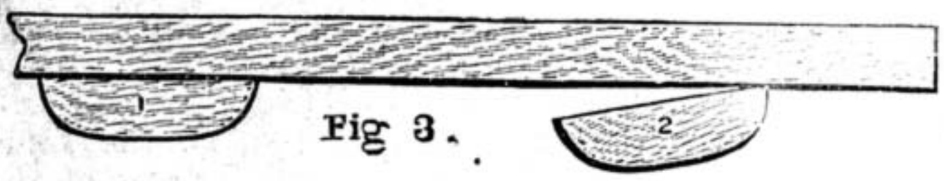

Fig 3.

Fig. 2.

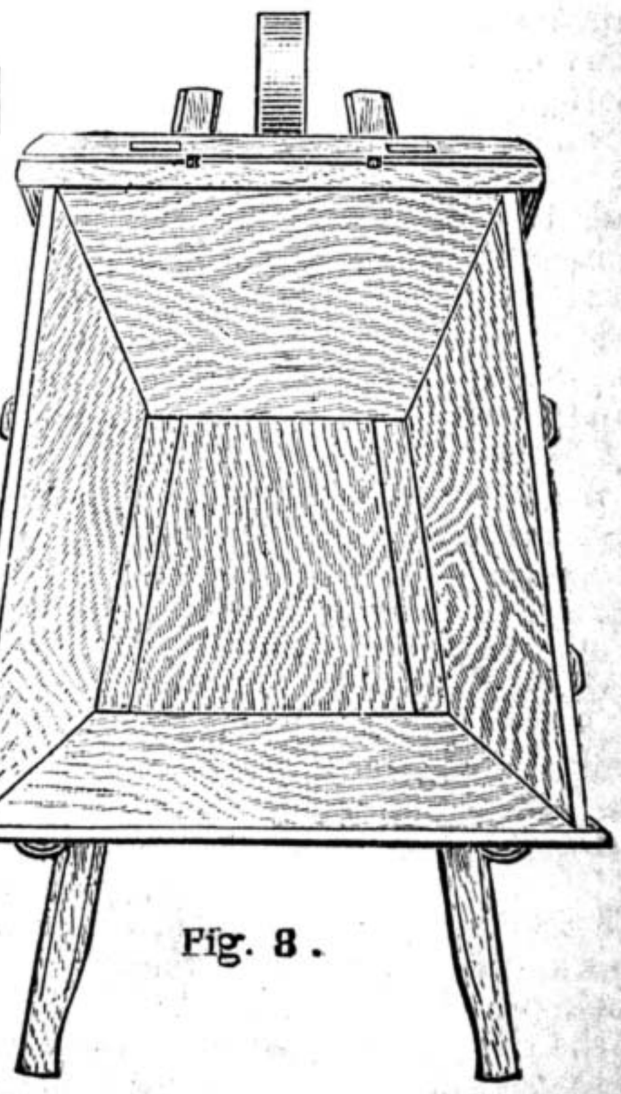

Fig. 8.

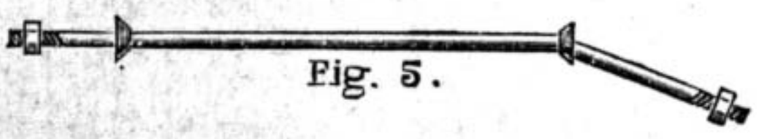

Fig. 5.

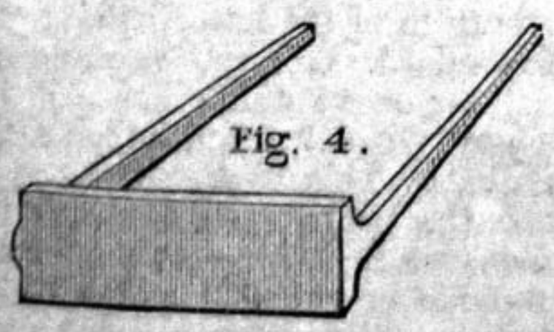

Fig. 4.

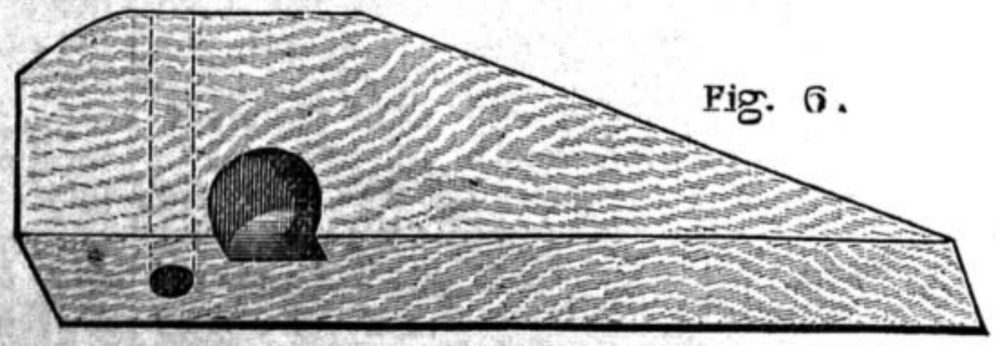

Fig. 6.

Fig. 1.—Curve of Handle. Fig. 2.—Shaft dressed off. Fig. 3.—Straightedge on Face of the Legs, showing Method of getting Legs set right. Fig. 4.—Square Staple. Fig. 5.—Front Iron Stay. Fig. 6.—Axle Bracket in Position as when put on Barrow upside down. Fig. 7.—Side Elevation of Barrow. Fig. 8.—Plan of Barrow seen from above.

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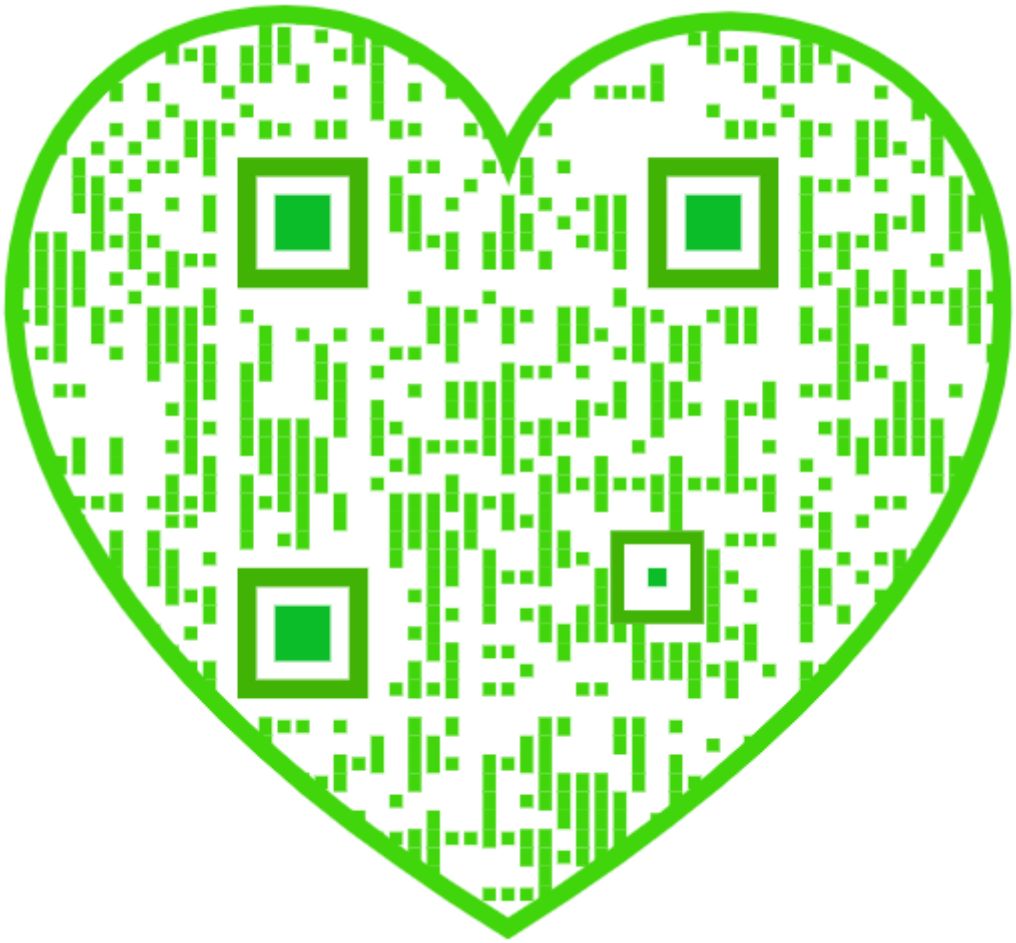

of the shaft at the wheel end 18½ in. Measure and place the other slot 25 in. from the handle ends. When right, place your left hand upon the slot to steady it whilst you mark it with a sharp pencil. First mark the shafts, by running your pencil by the side of the slot, thus marking the shaft on the top. Also mark underneath the slot by running your pencil along the inside of the shaft. When each have been marked, number the end of slot and shaft to correspond when fitting them together again.

We now get hold of a shaft, and you will observe that, although the slot was placed upon the shafts straight, yet the lines which we have marked do not go straight across the top, but traverse it slanting upon the top, 2 in. squared. We now get our square and mark down the 3 in. sides from the top. Get your gauge and set it to mark out an inch mortise, this to be in the centre of the side between the two pencil lines. When we have marked all our mortises out we bore with a bit and pare the mortise out with a sharp paring chisel. In boring and paring always meet half way, and try each tang, or tenon of slot, in its respective mortise. These tenons should fit in their places to a nicety. Of course, when we knock the slots in the mortise, we see that they only go in up to the pencil line previously marked upon the slot.

After we have put the framework together and found it right, we knock it asunder, and commence to dress the shafts off. In the first place, we chop some of the wood away from the inner side at the handle end. We next get our pencil and draw a curve underneath the handle end, or, better still, make a drawing on stiff paper, then cut it out with the scissors. Place the drawing, when cut out, upon the handle, and mark out with the pencil from the end of the handle to the curve, which runs into the full thickness of the shaft, the length of which is 10 in. (Fig. 1). This can be sawn out or chopped with the adze. After the curve of the handle has been chopped out, we commence to dress the shafts off. This is merely chamfering the edge in the same way as an Oxford frame. The chamfer is ½ in. wide in dressing the barrow throughout, so we, therefore, set our gauge a quarter of an inch to mark both sides of the shaft. In dressing out the shafts, we only dress the top off at the front, or wheel end, but at the back we dress off all the edges. Measure from the handle end 17½ in. From this measurement we commence to take the average off up to the handle end. Use your spokeshave round the handle, and leave it full at the end, so that the hands, when grasping the handles, will not slip off. Use the smoothing plane on the straight dressing off.

We now mark the front measure, 12½ in. This must be on the top of the shaft only. From the end we again measure 2½ in. in the centre and on the top. Get your square and mark across the top, down the side, and underneath the shaft again. Next get your brace and bit, and bore a ½ in. hole. This is to receive the front iron stay, which holds the head, or top piece, up in its place. We now dress the top edges off as in Fig. 2, which shows the shaft ready dressed off. We now fix our slots in the mortises, and knock the framework together. Before sawing the tenons off level with the outside of the shafts, measure across the wheel end to see that it is 12½ in., and the handle ends across the top of shafts 26½ in. We next knock a nail through the centre of the tenon and mortise, afterwards sawing the tenon off level with the outside of the shaft. Also insert two wedges in the tenon, to keep it tight in the mortise. Saw the ends off, and afterwards plane the outside of the shafts up a little to smooth it.

We now fix the bottom in its place. This can be of birch, oak, or any hard wood, 1 in. thick. This will be all in a piece, or, failing a piece, we can use two pieces, joining them. We do not plane the piece up, except at the sides, to ensure it fitting close up to the inside of the shafts. If we cannot get any hard wood, we shall have to use spruce deal. This bottom, when fitted in its place, should come over the ends of the slots just an inch. In nailing, use the 2 in. round wire nails, and, as the points come through, clinch them with the hammer.

We now get our barrow legs. These are generally of elm. If you have bought the legs ready sawn, you will have nothing to do but dress them off. In the first place, plane the legs up. The top part, where the back boarding is nailed to, has been, or should be, sawn to a bevel of 45°. Place one of the legs upon the shaft, letting the bottom of the bevel come in a line with the top of the shaft. This leg should cover the tenon in the mortise, say, about 1 in. from the back of the leg to the handle, and about 18½ in. or so, according to the length of the shafts. Whilst the leg is in this position, get your pencil and mark the leg by running the pencil along the top of the shaft and underneath. From these two lines we mark at the back with the square, then set our gauge ½ in., and mark from the side which rested against the shaft. We get our saw and saw this bevelled rebate out, afterwards paring it out with the chisel. When one leg is rebated and fitted to the shaft, get the other leg and fit it to the other shaft, exactly as we did the first.

We now get a long stay bolt, screwed at each end, and fitted with an iron washer and nut, the stay 27 in. long, ½ in. round iron. Bore a ½ in. hole through the centre of the leg and shaft, and see that both the holes are bored in a straight line with each other across the shafts. Screw a nut upon the end of the stay, and drive through a leg into and through both the shafts; then place the other leg on the end of stay, knock the leg on the shaft, put your washer and nut on, and screw the legs up in their places. We now place our straightedge across the face of the bevel. If you can move the straightedge, and, at the same time, let it touch the bevelled front of the legs, then they are set right; if it is as Fig. 3, it shows that the bevel requires a little more paring out in the rebate which fits upon the shafts. When we have got the legs fitted right, we take them off, and commence to dress them. The bevelled part, where the back is nailed to, is not touched, but all the other edges are.

We now get a pair of front standards. These are of ash or oak, 20 in. long, 2 in. thick, 3 in. wide at the bottom, and at the other end 1½ in. Plane two sides of this front standard true. After it has been planed, we place the standard against the shaft, letting the 3 in. bottom end of standard lie against the outside of the shaft, and 13 in. from the front of the standard to the end of the shaft. Let the standard slope at the top end towards the wheel end at an angle of 55°. Next, get your pencil, and mark the inside of the standard, by running the pencil on the top of the shaft. The face side of the standards at the 2 in. side looks towards the inside of the barrow. From this side we mark half an inch down from the pencil line which we have just marked on the standard. We saw this bevel out, and fix upon shaft. We next get the other standard and serve it exactly the same, always taking care to fit each standard to its shaft in marking out. We test the standards in exactly the same way as we did the legs. When right, we dress the front of the standards off. We also place a stay bolt through the standards and shafts same as we did the legs; but, of course, the front stay bolt is not so long as the back one.

We now get our top piece. This is a piece of ash or oak 28 in. long, 2¾ in. by 2¼ in. thick; we also plane this piece true. Before proceeding further, measure 12½ in. from the top of the shaft up the front of the standard. When you have marked both standards, lay your straightedge across the front of both standards and mark across them both with the pencil; from this pencil line we square each side of the standard. Then set our gauge 1 in. and mark all round from the true side; we saw the superfluous away with the tenon saw, thus leaving a 1 in. tenon, the ½ in. shoulder which we have just sawn away being at the front. Having planed our top piece, which will now be 2½ in. by 2 in., we place the 2½ in. side upon the shoulder of the standard, measure from the end of the top piece to the side of the standard, and see that they are at an equal distance at both sides. Next, run your pencil up each side of the tenon, thus marking the head piece; get the top piece off, and setting your gauge 1 in., mark from the top and bottom (after the pencil lines have also been squared from the lines previously marked on each side of the tenon). After we have marked our 1 in. mortise out, we bore and pare it out nicely; let the tenon slip in easy in the mortise. We next plane the two top edges off, the underneath edge at the front; we dress out between the standards, and from each standard to the end.

We next get four side standards, or brackets; these are generally of ash. The smallest length which fits against the side of the shaft is straight; it then runs up to a bevel of 65°. These side standards are 17 in. long, 2 in. wide, 1½ in. thick; place one near the front standard, and the other near the leg, mark each side of the side standard, bore a hole each side where marked, and drive in your square staple (Fig. 4), to hold the side standards in their places. We now get the side standards out, and take the average off the outer edge a little; do not dress the front part off which comes against the square staple, but leave it as strong as you can.

We now board the front, and this boarding throughout must be 1 in. thick. If we have not got a piece which will fit between the top piece and the bottom of the barrow, we shall have to get and joint two pieces together. Bevel the bottom of the board first, so that it rests upon the bottom of the barrow; next, plane the boards up and nail to the front standards; get your staff and pencil and mark from the head piece end down the bottom of the boarding up to the bottom of standard. Get your saw and saw down this line; serve the other side the same; we now get our board nailed to the level of the legs. This back will be 9½ in. high; plane the board up and bevel the bottom, to ensure it fitting—it should come over the outside of the legs a few inches at the top, then sawn down slanting, until it touches the side of the leg.

We now nail the back to the legs, then afterwards, saw and fit the sides in their

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places. Get your piece and mark it out at an angle of 55°; this is for the front; measure the distance between the front board and the back, then mark again a bevel at an angle of 45°; saw these sides out larger than required, as a great deal will come off in fitting them in their places. If we have not got a piece which will do for a side we shall have to use two pieces, putting the smaller piece at the bottom. After the sides are in—the height of which will be 14 in.—and when the sides are nailed on to the side standards, get your saw and saw the top of the legs and side standards off level. We now round the sides down to the top of the back.

Next, get your front iron stay (Fig. 5). This is a piece of ½ in. round iron, screwed at each end, and fitted with a washer and nut, and is 20 in. long; bore a hole through the top piece just over the hole in the shaft, take the top piece off, place your stays in the shafts, then knock the top piece on to the top of the stays. Then insert the tenons in the mortise, knock the top piece in its place, and screw up the stays; next, get a couple of wedges put in each tenon on the top piece, then saw the tenons off level with the top piece; next, round the ends off, first by sawing, then finish off with the spokeshave.

We now get a pair of axle or wheel brackets (Fig. 6). First, bore a hole through the bracket and fit it on the stay. Bore an inch hole in the bracket for the axle to revolve in; do not bore the hole too deep or the wheel will work itself out—about ½ an inch or so will be plenty. You will find that fitting the wheel in its place right is a very troublesome job; the general way to do it is place the wheel in its place, letting the axle rest upon the shafts; of course, the barrow is now upside down. Measure from the rim of the wheel to the side of the shaft; if right at the other side, give the wheel half a turn and measure again. We do this until the measurements are alike, or nearly so; get your pencil and mark round the axle, then mark the side of the wheel which comes to the right- or left-hand side of shaft, so that the axle will get back to its right place. Get your chisel and take a very little out of the shaft where we have just marked it, put the wheel in its place again, then put the brackets on. If you will now hit the bracket just over the axle, it will cause the axle to mark the bracket; this will have to be pared out with the gouge until the brackets fit nicely upon the shafts; rub a little oil upon the axle, and screw the brackets on their respective places.

We now require an iron leg stay for each leg; these are also of ½ in. round iron; the hoop which encircles the leg is 2 in. diameter round the leg. Knock the stay on, then get some very small iron wedges or nail stumps and knock in the wood next to the iron, to swell the bottom of the leg to keep it tight within the stay. We have now to nail four ribs in the corners of the inside of the barrow, and also four at the outside; these are so simple to make and fit that they call for no explanation.

We can now give the barrow a coat of priming colour; when dry, which will be in the course of a day or so, fill all the nail holes, cracks, etc., up with putty, then give it a couple of coats of red lead, or Brunswick green paint, ground in oil with driers, or whatever colour you may fancy. As I have only this article on the body of the barrow, I leave it to my readers to buy their wheel, which will cost them, including strong iron axle, about six or seven shillings, or perhaps you may have an old wheel, thus making a new barrow body for it.

BRICKLAYERS' WORK.

BY MUNIO.

Setting Out.

THERE are various methods employed in setting out a building. One is to stretch a line along the front, and fix another line at right angles to it, on the end or gable; another method is by centre lines at right angles through the centre of the building. In either case the lines should be squared by a large square set level, and the lines should be kept parallel to the blades of the square. From the two lines thus obtained, the remaining walls should be gauged. The walls should not be gauged from wall to wall, as an error in one would be carried through the whole. These lines can be checked by gauging the full length; the square should, of course, be perfectly true. An approximate method of squaring, which is sometimes used in setting out excavations, is as follows:—Fix one line and set the other as near at right angles as you can; then measure 6 feet on one line and mark it, and 8 feet on the other line, also marking it. If the lines are square, the distance between the two marks will be 10 feet.

When commencing the walls, a fixed mark or level should be set to work from. This may be the ground floor level; a post is driven in, or a fixed mark set, and from this all measurements should be taken. Should there be any addition to or deduction from the plan, it can be ascertained from this mark, and the dimensions of any additional work should be taken when built, as it will save the trouble of digging holes after the building is up. After the footings are brought up to the net size, the bond should be set out, marking off all openings for windows, doors, etc., and should there be broken bond, it should be worked under an opening, if possible. Broken bond occurs when the space between two quoins requires a closer less than a header or stretcher. If the broken bond is in a pier, it must be carried up from the bottom, in order to keep the perpends, that is, all the vertical joints to be exactly plumb over each other. The ingenuity of the bricklayer will be exercised in setting out the broken bond. Thus, for a stretcher and a quarter brick closer, he would substitute a header and a three-quarter closer, or, in Flemish bond, three headers in one course, and two stretchers above them in the next course.

Joints.

In carrying up the building, the joints should be kept as near of one thickness as possible, or the work will get out of level. After the first course is levelled round the building, a mark should be made at each quoin, and the plumbings, or "settings up," should be gauged from this mark. A rod or lath should be provided, the height of one story, with the level of sills and heads marked on it. This is a much better plan than using a two-foot rule, which is often done.

The joints of brickwork should not be made too thick, but the thickness will depend to a great extent on the quality of the brick used. Thus, a pressed brick, with an even, straight surface, will require a much thinner joint than a hand-made brick, the surface of which is rough, and a machine-made brick would require a joint somewhere between the two. The bricks for facing should be selected as near the same length and thickness as they can be got, selecting those with good square ends, for the quoins and reveals. In dry weather the bricks require sprinkling with water, as there is generally dust on the beds, which prevents them adhering properly to the mortar. Some qualities of bricks will require more water than others, being more porous. In wet weather the bricks should be stacked, or they will be saturated, and unfit for use till dry.

In walling a long length of brickwork, the line is apt to sag or droop in the middle. A brick should then be bedded in the middle of the course, and sighted from the quoins till straight; the line is then fixed to it by a small loop of cord, which is held by a piece of mortar, and a brick laid upon it. This is called a "tingle" brick. When building curved or circular work, plumbings are set up at various points, and the wall between these points worked by a curved rule; the plumbings should always be made at one place, a mark being carried up the face of the wall. In setting window sills and door thresholds, they should be bedded at the ends only, leaving the middle of the joint clear, or they are almost certain to be broken by the settlement of the brickwork. When three or four sills are in one range, the two outermost should be set first, and the others set to them by a line.

Damp Course.

As soon as the walls have been brought up to the level of the ground, a damp proof course should be laid on them to prevent damp being drawn up from the foundations. Different materials are used for this, sometimes slates bedded in Portland cement with the joints overlapping are used; sometimes a coating of asphalte, laid on hot, is used. In either case, they should be set hard, before being built on. A material, called fibrous asphalte, is also used. It is made in sheets, the width of the walls, and 32 in. long. It is laid with the joints overlapping each other 2 in., and appears to answer its purpose very well.

Air Bricks.

When the ground floors of a house are wood, air flues should be formed through the walls under such floors to admit of the circulation of air under them, or they will soon rot. Air bricks or grates are fixed in the face of the walls outside these flues. These should be galvanised, if of cast iron; they are also made in glazed stoneware.

The ground floor joists are supported on walls built under them, called sleeper walls. The hearths also have solid foundations built under them to rest on.

Inverts.

When a large building, such as a mill or warehouse, containing a great number of openings, is built, it is usual to form inverts, or inverted arches, on the top of the footings across the openings, in order to distribute the weight over the whole of the foundations. Fig. 28 shows an invert. The bottom of flue openings in tall furnace chimneys are formed with inverts. The lower half of barrel arches, culverts, and drains, are inverted arches.

Wood Bricks, Bond Timber, and Iron Bonding.

Wood bricks are walled into the quoins or angles of windows, doorways, and other openings for fixing the casings and linings. These should not be more than ¾ in. thick, as when made thicker they often get loose from the shrinking of the wood.

Bond timber was formerly much used in brick walls, and across openings to keep the

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work in line while being built, but as the wood was found to shrink after being built in, thus causing settlement, it is now nearly superseded by hoop iron bond, which is laid in the joints; the iron is generally coated with tar.

Relieving Arches.

Relieving arches are built over wood lintels, and sometimes over stone heads. They should spring from the ends of the lintel, as shown in Fig. 29; they are generally turned on a core or centre formed of brickwork, which should always be taken out as soon as the arch is backed up, and filled in again after the building has had time to settle. When large beams or girders for carrying floors, etc., are to be laid on the walls, a piece of hard flagstone, not less than 18 in. long, should be laid under them to give a larger bearing surface. These are called templates.

In carrying up the walls of a building, no portion should be carried more than one scaffold height, or about four feet above another, and in setting up the quoins they should be returned and sloped back, not set over, or toothed, as they are often done. The cross joints of the bricks should be well filled right through with mortar, and each course, as it is levelled up, flushed with mortar. This is better than "grouting," which consists of mortar mixed thin with water, and run into the joints, as after the water has evaporated the joints are left only about half full, and have to be gone over again. When the wall is very thick, a little water may be put in the mortar to make it work better, but each brick should be jointed right through with the trowel and flushed in at the top when levelled up.

Flues.

Great care should be used in building the flues. They should be carefully smoothed and plastered inside with lime and hair mortar, and should be made about 14 in. by 10 in. inside. Sometimes they are formed with fire brick tubes or pipes, called flue linings. The opening over fireplace is arched over, as shown in Fig. 30, the arch being turned on an iron bar turned

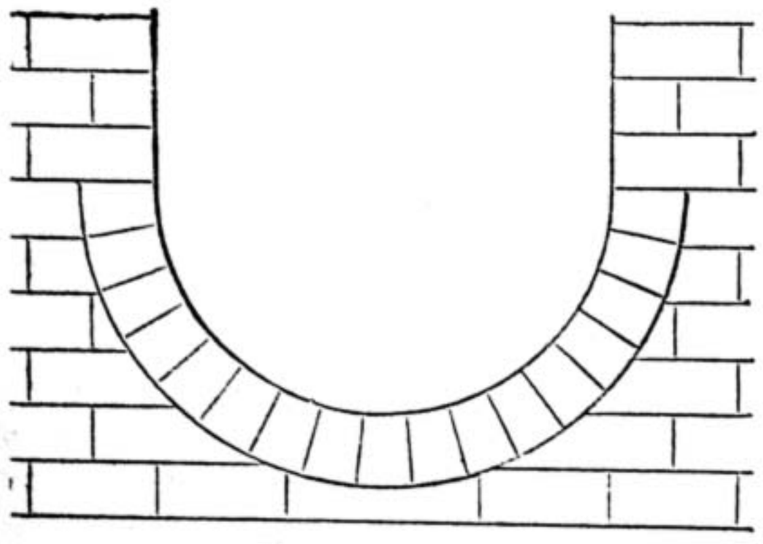

Fig. 28.—Invert.

up at the ends as shown by the dark line. As soon as the arch is turned, the flue should be set in to the size, flag stones or iron bars being used to support the bricks. If gathered over, or sloped, a cavity is formed just above the grate which is almost certain to cause a smoky chimney. The flue should be sloped to one side of the breast to allow room for the fireplace on the next floor, and no sharp angles or bends should be formed in it. When the flues from two rooms have to be gathered into one stack, an arch is turned between them to carry the flues; when the flues are brought through the roof, they sometimes require sloping in, and if a dressed stone is

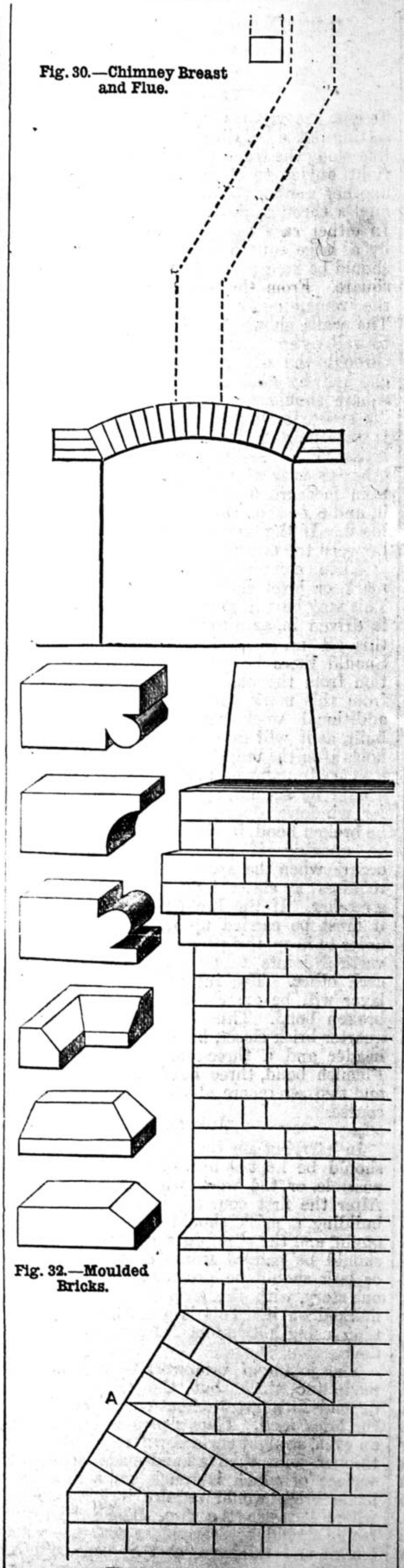

Fig. 30.—Chimney Breast and Flue.

Fig. 32.—Moulded Bricks.

Fig. 31.—Chimney Stack.

not used, the bricks are walled as shown at A (Fig. 31). A plinth course is generally put on above the ridge, the bricks for which are moulded. The top of the chimney stack is finished by projecting courses called oversailing courses, as shown in Fig. 31. Sometimes moulded bricks are used as a cornice; these are shown in Fig. 32. The top of chimney stack and oversail courses should be pointed with Portland cement, sloped to throw the wet off. Chimney pots should also be well pointed round with Portland cement. When a ventilating flue is carried from a room, it should be formed 9 in. by 4½ in. inside, and carried from just below the ceiling level, as shown in Fig. 30.

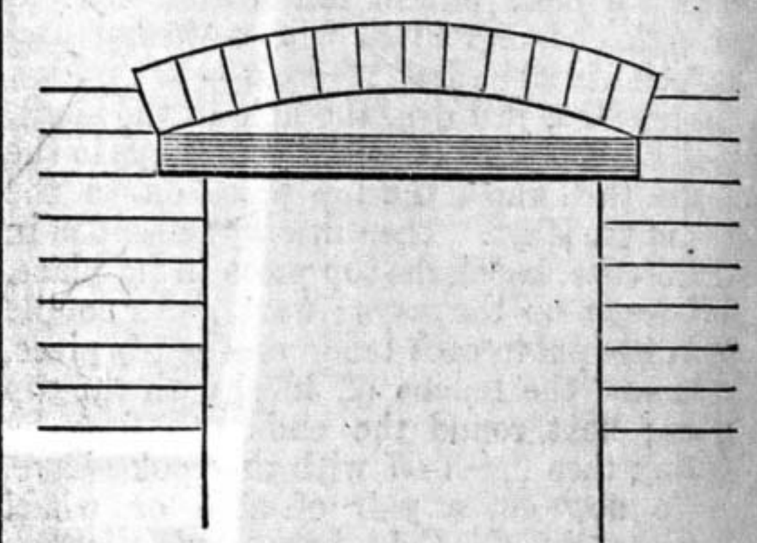

Fig. 29.—Relieving Arch.

The grates are set with fire bricks, neatly cut to shape and set with thin joints. The chimney pieces are fixed with fine mortar, mixed with plaster of Paris, and the tops of jambs fixed by brass cramps, let into the brickwork.

MILLING CUTTERS.

BY DAMON.

Such a large variety of work may be accomplished by the use of milling cutters, either in the lathe or in a special milling machine, that there is no doubt they would have a much more extended use if they could only be procured cheaply. In many of our modern workshops milling machines have almost entirely superseded shaping and small planing machines, as they will turn out more work in the same time. The price of the cutters is, however, prohibitive to many amateurs and small mechanics who have only a limited amount of work to do with them, and who are not overburdened with capital. I propose in the present paper to describe the method of making, hardening, and sharpening these cutters, for the benefit of such readers.

A handy little machine for the manufacture of the cutters is shown in the accompanying sketches. The same letters apply to all the views. Fig. 1 is a front elevation; Fig. 2 a side elevation; and Fig. 3 a plan. The machine is easy and cheap to make, and may be easily made by any one having only a moderate amount of skill as a "fitter." It consists of a table A on which slides the carriage B, which is moved forward or backward by means of the hand wheel and screw C. The spindle S of the machine is carried by the frame D, one side of which is extended to form the handle *d*. The frame D is mounted on the shaft E. By means of the handle *d* the spindle may be made to describe an arc, as shown by the arrow (*see* Fig. 2). The dead-centre S can be taken out by unscrewing the nut N to allow the different cutters to be put on the spindle, on which they are fastened by the little nut and washer shown. E also

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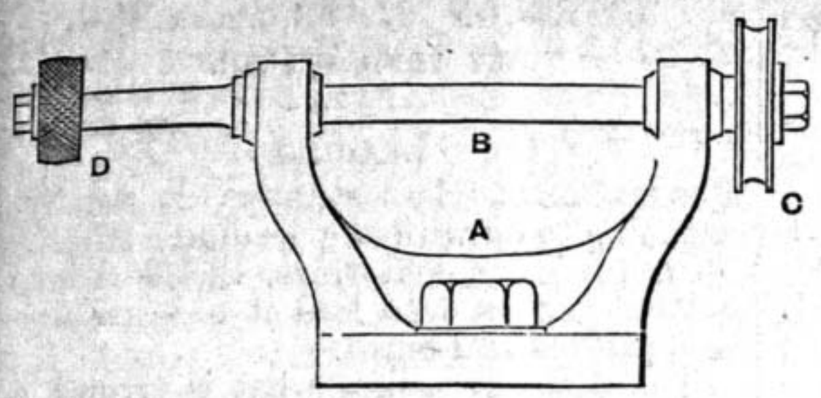


Fig. 7.—Grinding Apparatus.

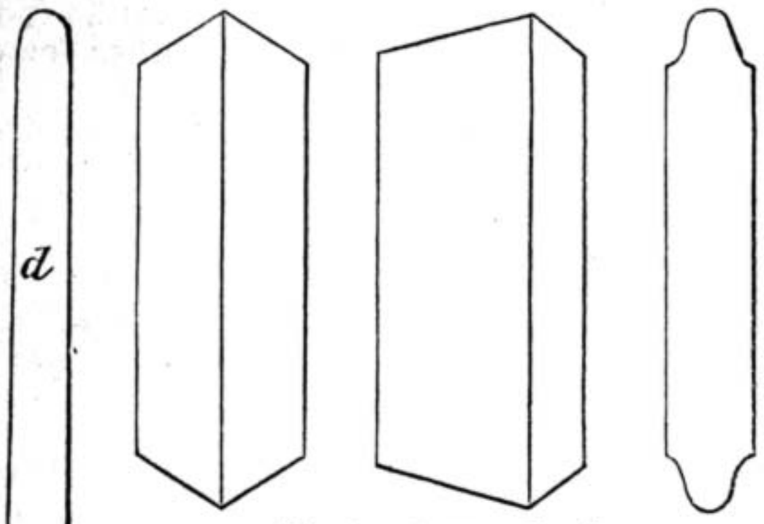
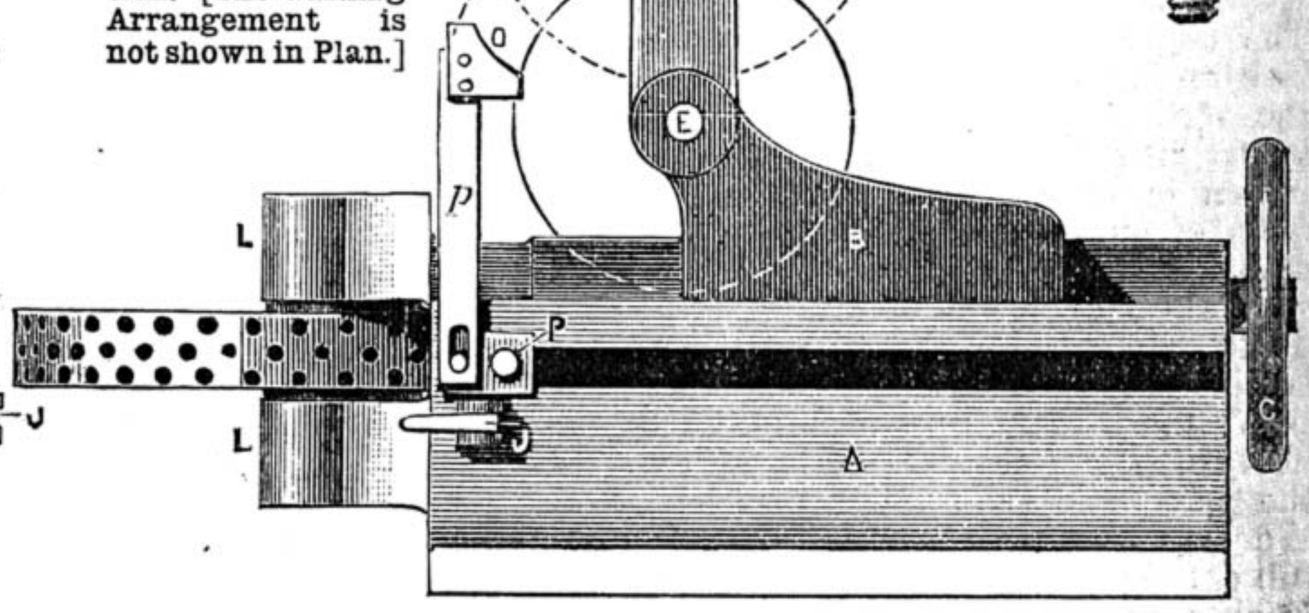


Fig. 6.—Cutter Blanks.

Fig. 4.—Mandrel. [*a*, *a* are turned to fit Bush on which Dividing Wheel H is keyed.]

Fig. 2.—Side Elevation. [The Guiding Arrangement is not shown in Plan.]



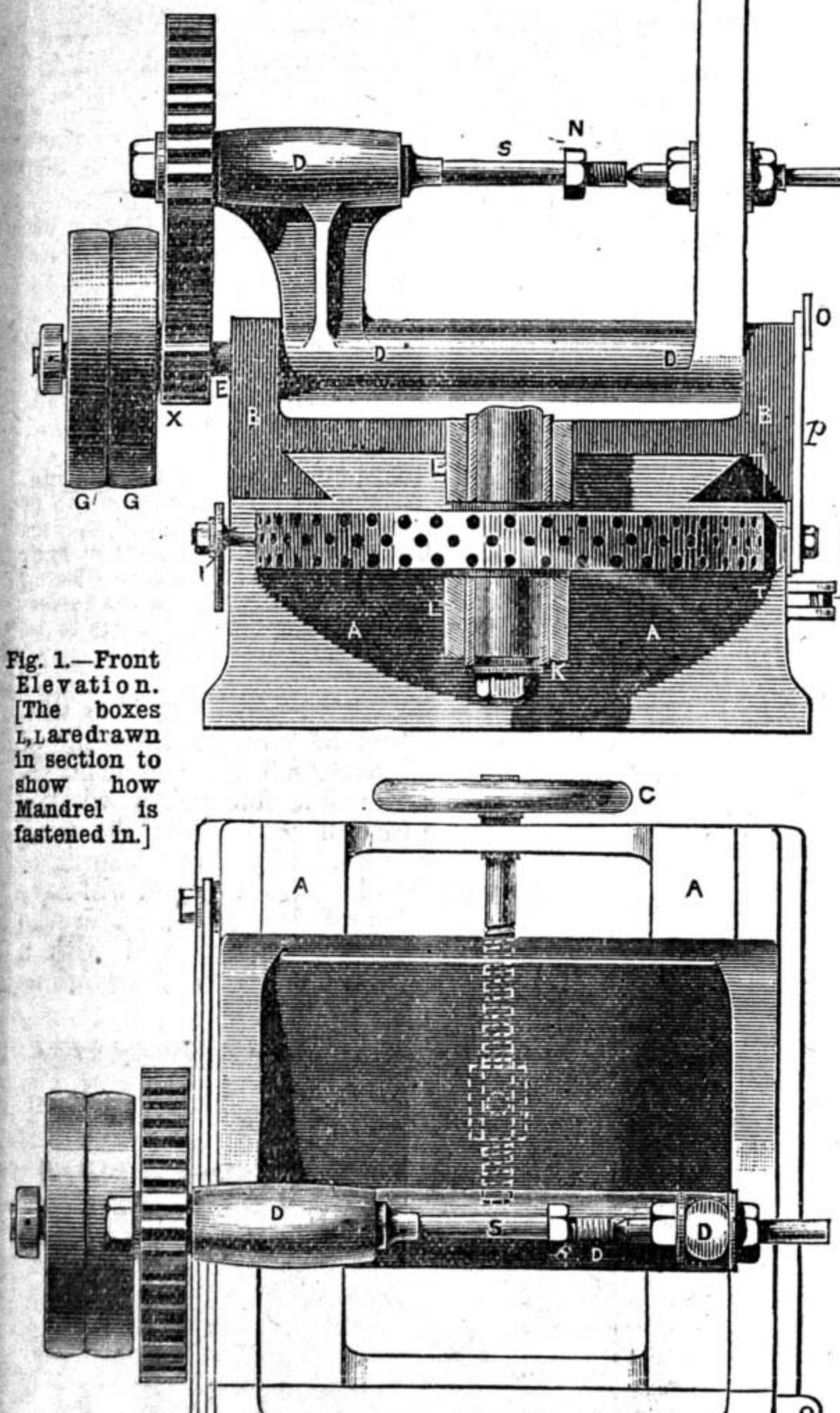


Fig. 1.—Front Elevation. [The boxes L, L are drawn in section to show how Mandrel is fastened in.]

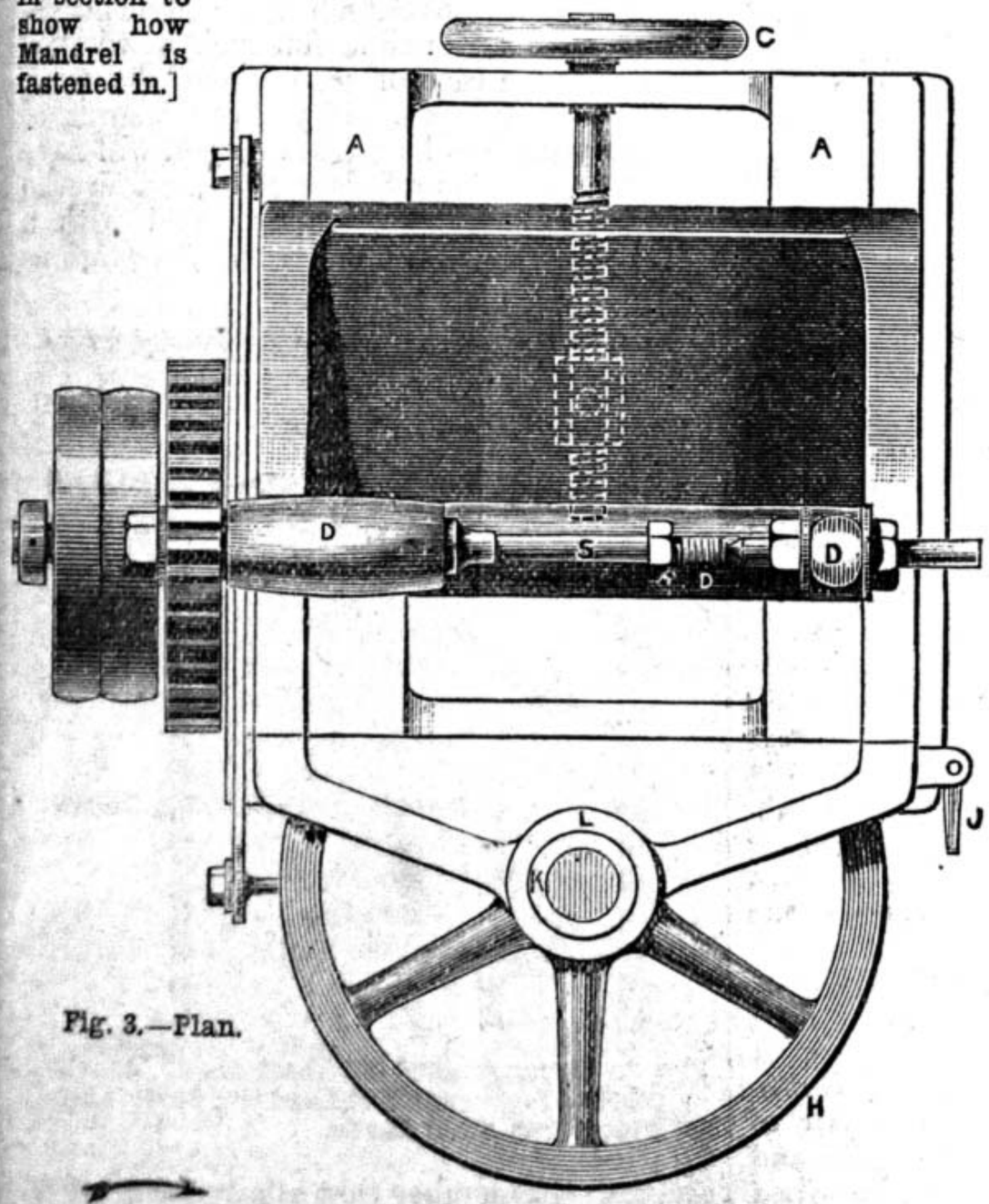
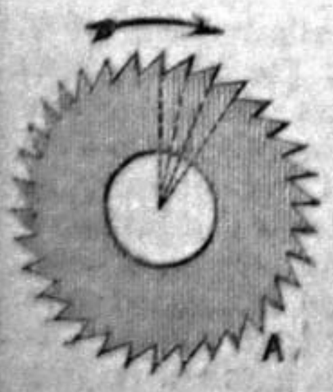


Fig. 3.—Plan.



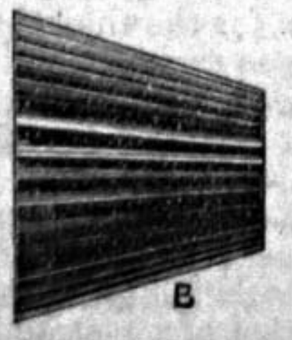


Fig. 5.—Cutter for use in Machine—A, Plan at Larger End; B, Side View. (Figs. 1, 2, and 3 are about quarter size.)

carries the two pulleys G, G'. The outside one runs loose on the stud. On the boss of the inside one (G) is keyed a pinion (X) which gears with the wheel on the end of the spindle, thus transmitting the power to the cutter. H is a dividing wheel, the periphery of which is drilled with any suitable number of holes. Three rows, having respectively 32, 30, and 25 holes, will be found as suitable as any. They may easily be drilled in the lathe by means of the dividing plate. I is a pointer, which may be thrown out clear of the wheel H by the eccentric handle J. The dividing wheel H is keyed on a bush K, which turns freely in the bosses L, L. Various mandrels are made, as shown in Fig. 4, to hold the cutter blanks while they are being operated on in the machine. The part *a* (Fig. 4) is turned to fit the hole in the bush K. A small peg is inserted in the side which fits a notch in the bush, and prevents the mandrel turning round when it is being screwed up. The part *b* of the mandrel is turned to fit the hole in the cutter blank, which is fastened on by the nut and washer shown in the sketch. The small cutters which are used in this machine can have the teeth filed in by hand. They need only be from an inch downwards in diameter. A piece of steel rod is taken the required length, and drilled to fit the spindle, which may be $\frac{3}{8}$ of an inch in diameter. It is then driven on a mandrel, faced up on the ends in the lathe, and turned to the required size and taper. The amount of taper is determined by the amount of clearance it is desired to give to the teeth of the cutter we are going to make. It also varies with the diameter of this cutter. Taking two cutter blanks, one say two inches and the other three inches in diameter, the cutter used in forming the teeth in the first case would require less taper than in the second, to give the same pitch of teeth. As you are rather limited in choice as to the number of teeth, it is best to set out the shape of the teeth on a piece of tin, and file it up as a template to turn the little cutter blank up to.

Having the little blank turned up we proceed to file the teeth. The cutting face should be in a plane radial from the centre of the spindle, as shown in Fig. 5. Having filed the teeth as evenly as possible, the little cutter will require hardening and tempering. It should be heated to a "cherry" red and cooled in water; then polished on the ends, and carefully let down to a "nut-brown" or "dark straw" colour. If the profile of the cutter is angular or symmetrical like those shown in Fig. 6, we shall require two small cutters such as have just been described, one right-handed and one left-handed. When cutting, the spindle of the machine must be guided to form the outline of the cutter. The guiding arrangement of the machine in question is shown in Figs. 1 and 2 but not in Fig. 3. It

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consists of a slot T planed in the side of the table A. A plate r slides along this slot and may be fastened in any position by the bolt shown. To this plate is screwed another plate *p*, which stands vertically. The screw which fastens this plate passes through a slot, to allow of vertical adjustment (*see* Fig. 2). To the top of plate *p* is screwed the template o which is carefully filed up out of a piece of sheet steel about $\frac{5}{32}$ in. thick. The tail end of the dead-centre is extended beyond the handle *d*, and rests on this template. It is held down upon it by the pressure of the hand, when the machine is working, and may be lifted up clear of it when it is desired to examine the progress of the work.

The cutter blank, having been carefully turned to shape and polished, is slipped on the vertical mandrel and fastened by the nut. The number of teeth having been settled on, the pointer I is set to that row of holes in the dividing wheel H, a suitable cutter is put on the spindle S, and the proper template screwed to the plate *p*. The larger face of the cutter on S must be carefully set in a line with the centre of the vertical mandrel. This may be done by packing it with suitable washers. The reason is, of course, to make the cutting faces of our cutter radial. We are now ready to start. In starting the first tooth care must be taken not to cut the full depth, a mere mark which will show the cutting edge only being required. The blank must then be moved round to the next tooth, and the template o adjusted till the spindle is following the right shape. We may now cut all the teeth, going the full depth with each one as we proceed, just leaving the "turning marks" in. If the shape of the blank requires it (*see* Fig. 6), it must now be turned over and a little cutter of the other hand used to cut that side. The blank is now ready for filing up. If it is intended to grind it before use this filing up may be omitted. If the teeth are filed, care should be taken not to make one smaller than another or the cutter will "run out," and not leave so good a finish on the work. Besides, the largest tooth getting an undue share of the work will soon wear dull, and greater power will be required to drive the cutter, and if it is being used in a foot lathe the workman will soon appreciate the fact. If the outline of the cutting face is curved, as in the case of a cutter forming the teeth of wheels, it cannot be filed, nor yet ground without special apparatus for guiding the emery wheel, which it would not pay the occasional user to obtain. A scraper made out of a square or triangular file, used endways, may be used in these cases.

The cutter is now ready for hardening, though if a key-way is required it must be cut first. If it is required to stamp or mark it, of course it must be done while the cutter is soft. For hardening, a good fire must be made, and the cutter heated to a dull red, then "potashed," to make up for the carbon burnt in heating, and further heated to a cherry red, care being taken to heat it equally all over, or it will probably crack in hardening. When sufficiently heated, it should be taken from the fire and plunged steadily, with the flat side downwards, into a trough of water. When cold, the sides of the cutter and the backs of some of the teeth should be polished with emery cloth, so that we can accurately observe the colour in tempering. An iron rod, rather less in diameter than the hole in the cutter, is now heated. It is better, by the way, to have two such rods, so that as one cools the other may be heating.

The cutter, having been oiled all over, is slipped on the hot rod, and turned round so as to apply the heat evenly. The change of colour must be carefully watched. A "dark straw" or "nut brown" is about right. When the change of colour has reached this stage the cutter must be plunged in cold water. When wiped and oiled it is ready for use, or grinding, as the case may be. If the hole in the cutter was bored a good fit on the mandrel, it may possibly be found to be too small now. If this is the case, a "lead lap" and emery powder will soon rectify matters.

The machine which has just been described is not suitable for making cutters the cutting faces of which are parallel with their axis. The reason may easily be seen by looking at Figs. 1, 2, and 3. The axis of the blank is vertical, and the spindle s of the machine cannot be made to describe a vertical line, and cut properly. This class of cutter may, however, be easily cut in the lathe, by first making a cutter which will give the proper shaped tooth. Use this cutter in a horizontal cutting frame in the slide rest, having the blank on a mandrel between the centres.

For any other class of cutter, however, the machine is perfectly suitable. Where there is only a small face parallel with the axis, the slight concavity which the cutter gives to the tooth is easily removed with a file.

For surfacing large areas, the teeth of the milling cutter should be in a helical or "screw twist" form. These are best cut in the lathe. The slide rest is arranged as for screw cutting, so that it moves sideways while the blank is turning round the right distance. The pitch should be such that as one tooth is leaving the work, the next is just starting. By so arranging them, the cutting of the teeth is smoother, and they are not so liable to break off.

When a cutter becomes dull with use, it may be sharpened by grinding. A little grinding apparatus is shown in Fig. 7. It is adapted for fastening on top of the slide rest. It consists of a bracket A which carries the spindle B. At one end of the spindle (or in the middle, according to fancy) is a pulley C, and at the other end the little emery wheel D. The cutter which requires sharpening is put on a mandrel between the lathe centres. It is as well, if possible, to use the mandrel on which it is going to be used. By doing so we ensure its running true. The emery wheel must be at such a height that it will give the necessary amount of clearance to the teeth. It is driven by a cord from the overhead motion, and is traversed across the face of the cutter by means of the screw of the slide rest.

I do not recommend doing much grinding on a good lathe, because the emery dust gets into the bearings, and on the slides. A serviceable grinding machine can be improvised out of an old slide rest and a pair of centres. By taking the wheel off the end of the spindle s in the machine described above, and putting a small pulley in its place, with a small emery wheel on the spindle instead of a cutter, the machine may be used for grinding. I have done this with fairly satisfactory results, except in the case of wheel cutters, which I prefer to "scrape" to a cutting edge. I trust that the machine which I have endeavoured to describe will be found useful by many.

NOTES ON GLASS PAINTING.

BY FRED MILLER.

Leading.

PROFESSIONAL glass painters do not have anything to do with the leading. All they do is to design and trace, the glass being cut by glaziers, who lead it together when it is painted and burnt.

The designer makes what is termed an outline, that is a kind of tracing of the window showing the shape of the various pieces of glass, and as a result of this where

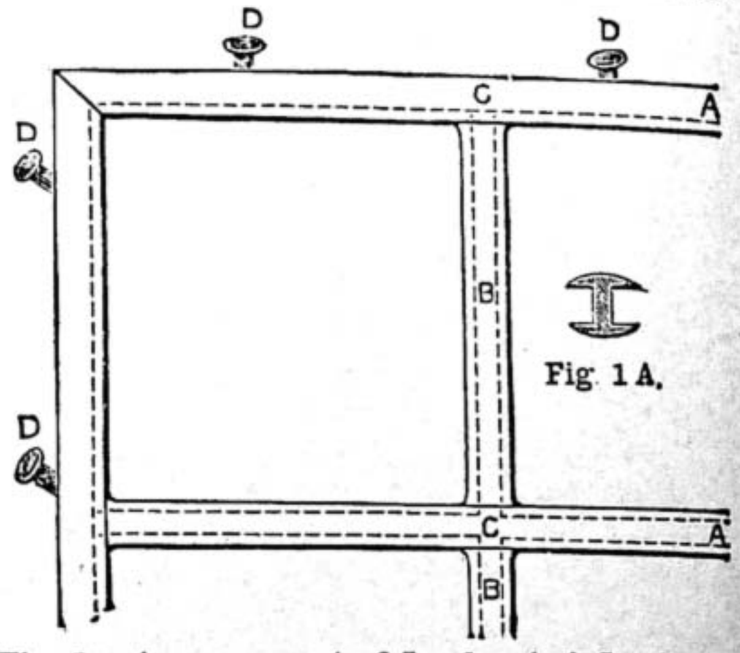

Fig. 1A.

Fig. 1.—Arrangement of Leads—A, A, Leads running Length of Blind; B, B, Leads width of Squares when between Leads A, A; C, C, Corners at which Leads are soldered together Back and Front; D, D, Nails stuck into Glazing Board to keep Leads together before Soldering. Dotted Lines show size Glass has to be cut as Lead has to clip over Glass.

the leads come. We are dealing here with the simplest kind of leading, consisting of squares with lines outside and a circle inside. In making an outline for such a window it is merely a case of setting out the work geometrically exact. If you are desirous of trying your hand at leading you will have to procure leads and glass of some firm who make stained glass windows, and with a diamond cut the glass into the various

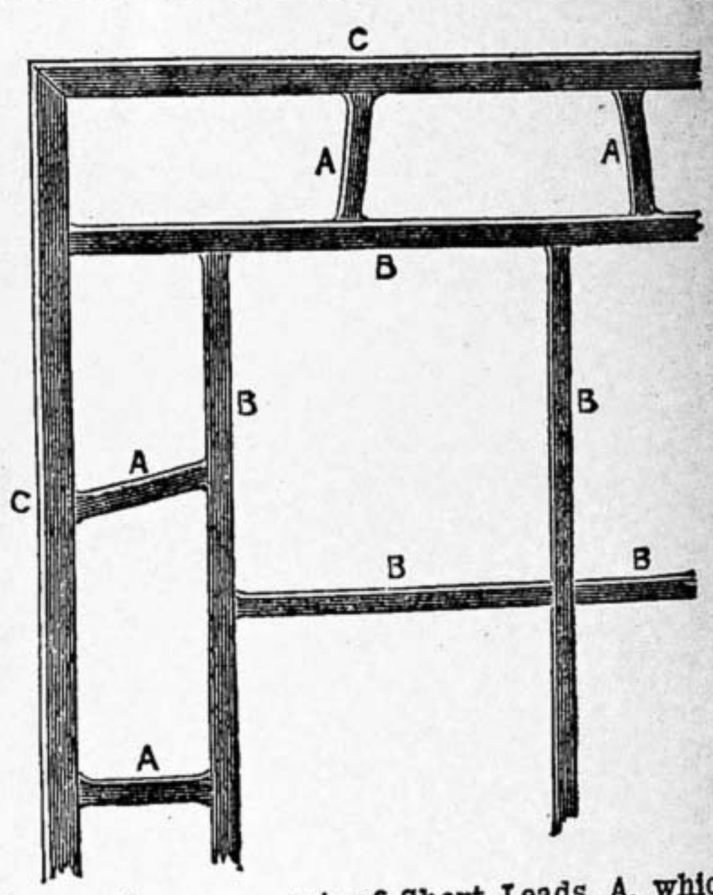

Fig. 2.—Arrangement of Short Leads, A, which come to right or left of Leads B; Outside Leads wider than other Leads.

shapes. Remember that allowance must be made for the thickness of the lead coming between each piece of glass; it is therefore necessary to cut each piece of glass a trifle under the size marked on outline, so that when the work is leaded together it does not spread beyond the outside of outline, as it would do if due allowance were not made for thickness of lead. Fig. 1 A is a section of a lead, and it is made in varying

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widths and depths, the narrower being used for small pieces, and where the design is of a geometrical character, and the larger leads for important joins. For ordinary work, such as window blinds, a ¼ in. lead will do. We will imagine the blind consists of a series of 3 in. squares, with ruby and white "lines" outside (narrow strips of glass outside the work are termed "lines"). The leads A, A running the length of the window can be in strips, and as each square is slipped between the long leads, sections, B, B, the width of the space between the lengths, must be put in as at Fig. 1. The leading should be done on a board as the glass is kept in its place by means of nails D, D. In leading lines on outside squares the short leads between the several pieces should come at irregular intervals, and not follow the direction of the leads between the squares (Fig. 2). This intentional irregularity gives character and quaintness to a window. I always like to see a white line about ½ in. wide around the outside of all work, as it frames it in, but a ruby line next to the white also looks well. The short leads in both cases should come at irregular intervals (Fig. 3), and the corners should come "under and over." In cutting the glass for lines cut long strips, and then piece them so that your joins come where you want them.

It looks a good deal better to vary the

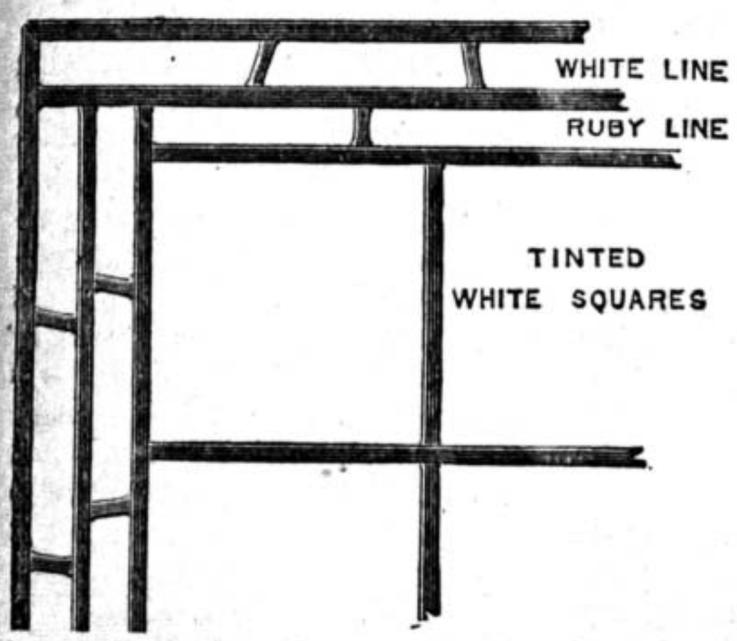

Fig. 3.—Diagram showing Leading of Outside Lines and treatment of Corners.

tints of glass, and instead of using glass of all one tint for the squares, to have, say, a white, yellow-white, green-white, warm-white, and so on, and put them together indiscriminately. In this case the white line outside can be pure white. The makes of glass are numerous, but clear glass is rarely used for leaded windows unless it is desirable to see through the glass. Glass is made with a certain unevenness of surface as in "anbetti," which has a sparkling effect owing to the light catching the little excrescences; "sanded" white, so called from small portions of sand being rolled into the glass when it is soft; "antique," which is made in the mediæval way, by blowing a globe of glass and then cutting an opening at the side opposite the blowing rod or "punt," and whirling it until the globe opens and becomes a disc of glass, thicker in the centre where the punt is fixed, and thinner at the extremities. A good deal of the effect of a church window is obtained by using different makes of glass for the different parts of the window, and "antique," by its varying so much in thickness and surface, gives a sparkling look to a window. The flesh tints and white drapery in figure windows are usually cut out of "antique," but for ordinary squares it is not so generally employed, as it is much more expensive than other makes. "Cathedral" is another glass largely used. It is rolled while soft, and has a kind of wavy surface, which prevents it being seen through. It is made in a large number of tints and is much employed for church windows that are plain glazed, *i.e.*, not painted; but for small work such as window blinds it produces a harsh, cold effect, and I give the preference to anbetti. It is not a good plan to introduce two or more makes of glass into the same window (except in the case of figure windows), as you want to obtain variety without harshness, and this can only be accomplished when each piece blends with those around it. This remark does not apply to the outside white line, which can be of "Cathedral," while the squares are anbetti.

The coloured glasses, such as ruby, blue, green, etc., vary a great deal. The finest colours can only be had in "antique," and in this make of glass the colours are very beautiful. For the ruby line in the window blind you might be able to get some fragments of antique that you could cut into strips. A ruby line only looks well when the glass shades itself, *i.e.*, when it varies a good deal in tone, a dark piece coming against a light piece, and so on, and you only get this variety with antique; but it is expensive when used in any quantity.

When you have leaded your window, you must solder all the joins on one side and then turn it over and solder them on the other side. But the window is not yet finished, for the glass rattles about in the lead, and if placed outside, or to act as a window in a house, the weather would get through between the glass and lead. Cement, consisting of white lead, black lead, linseed oil, putty and driers made stiff, is brushed over the window and worked well into the leads on both sides until all gaps and spaces are filled out. When this gets quite hard it makes the leading quite stiff, and it is not so liable to bend, though in large windows it is necessary to have iron bars to help support the weight of the lead.

Leading and glazing is not difficult, and to those who can work exactly offers a good field for their labour. The cutting of glass is a little troublesome at first, especially when the glass has to be shaped to fit the various portions of a design, for the diamond must be held at one particular angle.

Leads and glass could be obtained at a moderate price from some good stained-glass firm, such as Pepper & Boyes, 174, Euston Road, N.W., and I don't see how you can dispense with the help of some firm of the kind, as the leads are turned through a vice, an instrument it would not be worth while for an amateur to purchase; and as you only require glass in small quantities, you could not go to a wholesale warehouse or a manufacturer's for what you wanted.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

Modelling in the Round.

Copying a Bust from the Antique—How to Support It—Sketching in the Round—Methods of Getting a Good Surface—Copying the Entire Figure—Frames for Statuettes, and Building Them Up.

Let us now see how the modeller would set about copying a bust from a cast from the antique. He will, in the first place, need a frame to support his work. In Figs. 14 and 15 are given an elevation and section of a good and simple frame for the purpose, which any one may make for himself, or readily get made. In both these diagrams A marks the flat bottom board, of sufficient size, say 15 in. by 11 in., which is braced together by two ledgers to prevent warping. B is an upright of sufficient height to reach to about the centre of the head; a tenon at the bottom of this upright passes through a mortise in the middle of A, where a peg C, removable at pleasure, tightens and secures it. Through a second mortise near the top of the upright passes the short cross-arm D, also removable at pleasure. On this arm will chiefly rest the weight of the head. The cross-arm and upright are made easy of removal from their places, to facilitate taking the clay from the mould in the process of casting, as we shall see when the moulding of busts comes to be spoken of. Wood has an advantage over iron, as forming the support of a bust, in this respect—that if through alterations in the model in course of the work any part of the frame should become exposed, that part may be easily cut away. Leaden piping is sometimes used for the upright, but this is rather for busts from the life, when flexibility may be required; wood is better for our present purpose when the position of the head is absolutely settled beforehand.

When copying a bust or other work in the round, it is well that both cast and model should be on turn-tables, that all sides of them may be readily brought under the eye, and that both should be on the same level.

These arrangements made, the frame is damped, and the clay built up around it. It may be thought that in putting together a comparatively large mass, it can matter little whether the clay is well tempered or otherwise, or that the building up should be done methodically. But the modeller should not be guided by such slipshod ideas. All clay shrinks as it becomes drier, and in badly-tempered clay the soft parts shrink more than the hard. A "lumpy" and irregular surface may result from negligence in this respect, as it may from air-holes in careless building up. So far as the experience of the writer goes, thorough workmanship is as desirable in modelling as it is in most other things.

Roughing-out a bust, though only from the antique, is highly interesting work. The modeller needs to discern clearly the characteristic points of his original, so as to get resemblance by the disposal of his great masses only. This he ought to be able to do quickly; and all the leading features may be expressed by a few effective touches. The thumbs pressed deeply into what will afterwards be the inner corners of the eyes, and then drawn outwards, marking the line of the eye-brows, at once give a human look to the upper part of the face. A deep, somewhat crescent-shaped indentation at the opening of the ear, and an oblique line drawn with the thumb-nail, marking its hinder limit, something more than indicate that organ. A few sharp incisions of the tool bespeak hair where it falls upon the flesh. The position of the mouth and something of its expression are given by a slight depression at each of its angles, and drawing the thumb downwards from them. In this stage an ingenious modeller throws a vast amount of resemblance into his copy with marvellously little labour; and it is well that the learner should practise the means of doing this. It at once gives interest to his work, and facilitates after-labour.

Although in some respects it is more

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difficult to copy in the round than in relief, the worker has this advantage—he can now take measurements in all directions. This should be done freely, but in an intelligent manner—that is, the dimensions of each form should first be judged by the eye, and afterwards tested by the callipers. The eye is thus trained to accuracy, and will after a time become so exact that scarcely any measurements will be needed. It is well to acquire this habit before working from the life, for a frequent application of the callipers is not pleasing to sitters for portraits.

In working up the forms of the more intricate features—such as the eye and mouth—the main part of the work must needs be done with tools; but in life-sized work—such as we suppose the present to be—the eyeball is best formed by the thumb. But the upper eyelid cannot be completed without the tool, and it plays so important a part in the expression of the face that form should be given to it at a comparatively early stage. The lower eyelid is rarely put in till later. This, in an unfinished state, takes off from breadth of effect in a painful manner, and, to keep it from being offensive, needs a great deal of softening down. It may be well to see how this is done.

In large forms, where the thumbs can work freely, softness seems to come naturally; but in less accessible parts the harsh marks left by tools have to be removed in order to give finish. Working across any line—say, as this of the eyelid—with a fine tool and a light touch, will do much. Sometimes what painters call a hog-tool, with the bristles cut rather short, is used, it being first dipped in water. In delicate matters a sable brush, also cut short, may be used instead of, or after, the hog-tool; and a final dabbing with a fine, moist sponge blends all together and makes a good surface. For small work a scrap of sponge tied to a bit of stick as a handle is useful for parts which cannot be reached with the fingers.

Whilst discussing such matters, it may not be amiss to speak of the mechanical plan of producing a presentable surface on flesh, etc., to which allusion has already been made. The modeller gets a piece of that ribbed stuff of which cotton stockings are formed, more or less coarse, according to the nature of his work. This he wraps tightly and smoothly over his thumb, with the ribs running across it, and, having damped it, works it firmly but lightly over his surface. The ribs to a slight degree cut into the clay and reduce it to smoothness, and this, with an after-dabbing with the sponge, produces a great appearance of finish.

Those who are learning modelling, rarely undertake to copy a whole life-sized statue in the dimensions of the original. The great quantity of clay required, and the cost and difficulty of providing sufficient support, deter them from doing so. For the mere purposes of study, it is held sufficient to copy some of the antique statues on a smaller scale, or, in other words, to reproduce them as statuettes.

In Fig. 16 is shown a section of a frame for the support of a standing figure some two feet high. This will give a tolerable idea of the method of supporting these things; but to any unusual attitude the frame must, of course, be specially adapted. The board on which the figure stands is marked E; and strongly screwed to this, near one end, is the upright bar of iron F; this is bent near its upper end, that it may enter the figure at the small of the back. At its termination is the shank G, which will occupy the centre of the lower part of the body. When this frame is prepared for use, three pieces of gas-piping will be bound with copper wire to this shank. Two of these will descend to the board below, and will be arranged to run down the middles of the legs; their upper ends, after being carried straight upwards to the height of the shoulders, will branch off, to support the arms; and the third pipe, running up to the centre of the head, will carry the weight of that important member. This will be tightly bound to the arm-pipes for so far as it keeps company with them, and to its top some cross-bits of wood will be wired, for the better support of the clay forming the head. The clay will hold more firmly to the pipes generally if wires are wound spirally round them. For figures of moderate size, lead or "compo" gas-piping admirably serves the purpose of skeletons; for whilst strong enough to bear the weight of the clay, it admits of being freely bent in any direction.

It is no easy matter for an unpractised modeller to give the proper pose and action to a figure in the round; even making it so balance as to give the idea of standing securely may perplex him at first. He will have to make free use of his plummet, and to bend and re-bend his pieces of gas-piping many times. He will, however, be surprised to find with how little beyond a mere skeleton it is possible so well to express the action of his figure as to produce a decided resemblance.

If figures of this kind have to be kept long in the clay, it is desirable to have an oil-cloth covered frame to fit over and keep them moist.

Nothing more needs to be said with regard to copying from the antique. Such copying, though pleasant and interesting work, is, of course, but a means to an end. Those who do it, are generally only seeking to fit themselves for dealing with portraits, or for expressing the inventions of their own imaginations in ideal sculpture. Some there will be who read this who will have no such aspirations, but will look to modelling ornament only. To these we would say that, if they can spare time for some little studying from the antique, they will be no losers by it, even as ornamentalists. The antique statues teach lessons of just proportion and beauty which cannot fail to improve the taste. But if time does not serve, let them copy from casts of good examples of ornament. Such are easily to be got, whether classical, mediæval, or modern, and all necessary technical directions they will find in these articles, for these directions are equally applicable to decorative or figure modelling.

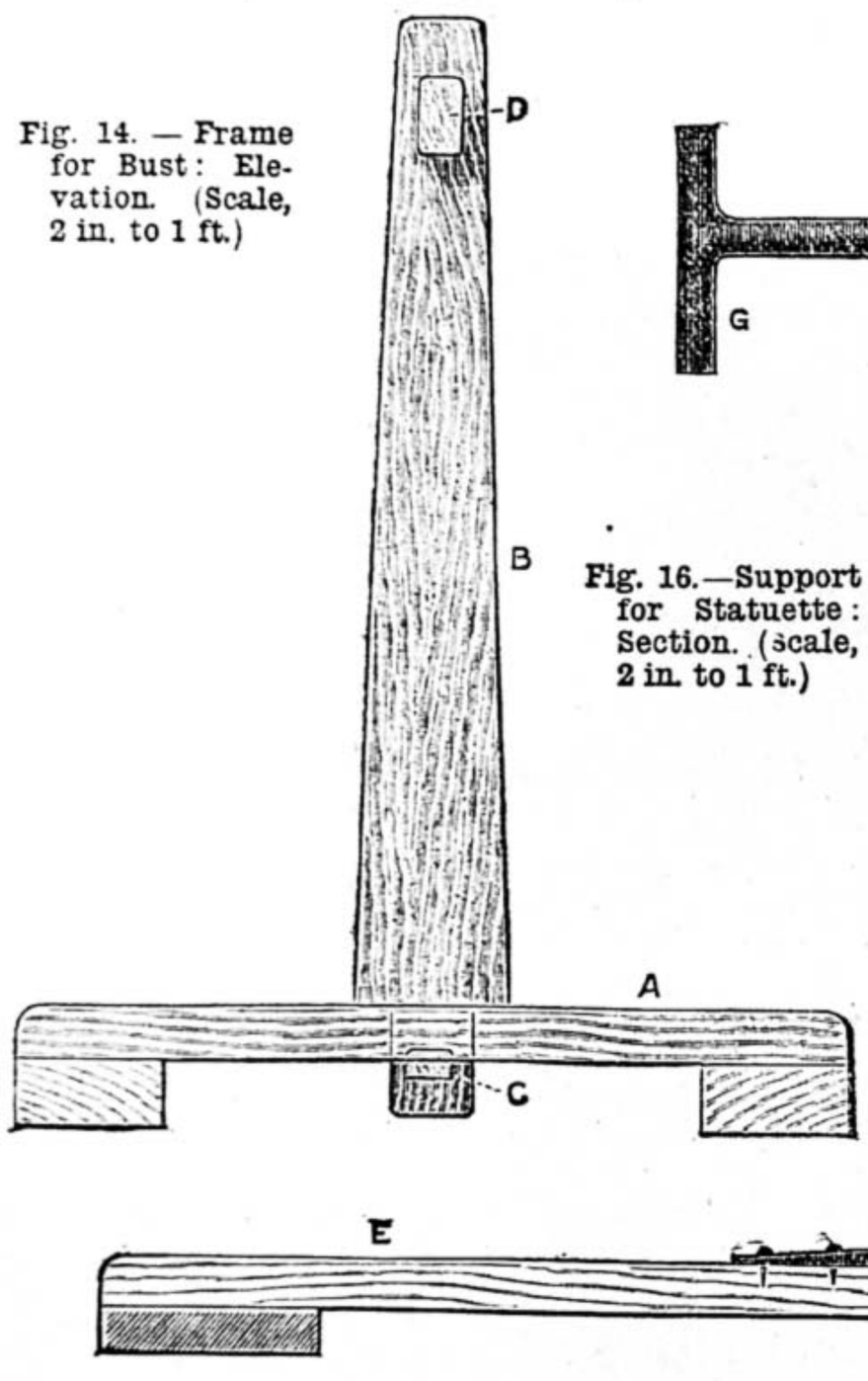

Fig. 14. — Frame for Bust: Elevation. (Scale, 2 in. to 1 ft.)

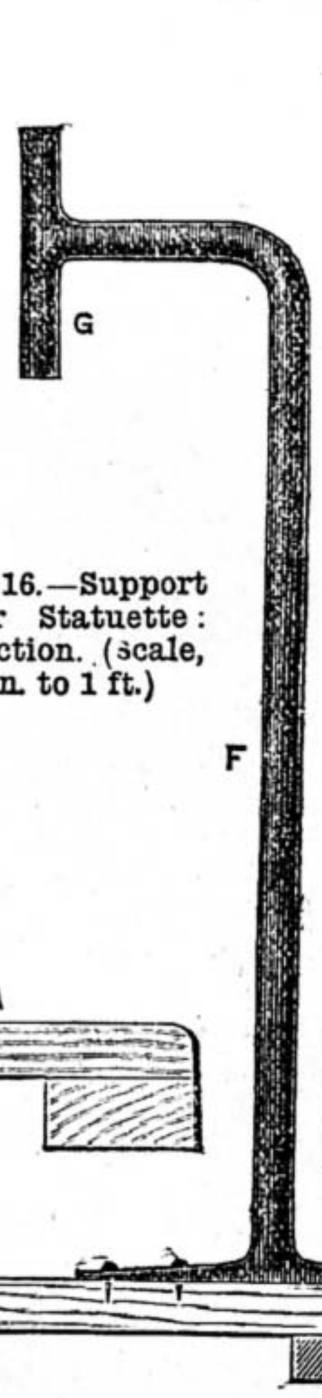

Fig. 16.—Support for Statuette: Section. (Scale, 2 in. to 1 ft.)

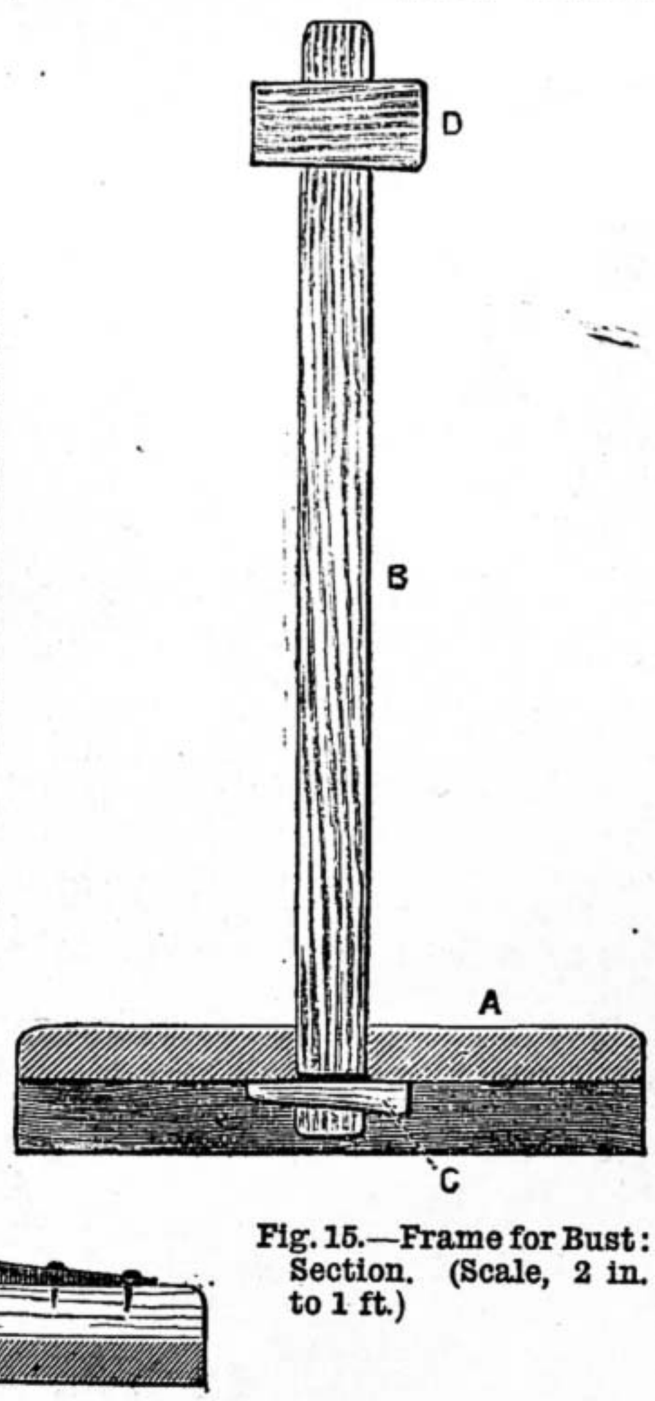

Fig. 15.—Frame for Bust: Section. (Scale, 2 in. to 1 ft.)

DRAWING BOARD FOR DRAUGHTSMEN ON WOOD AND IMPROVED INSTRUMENTS FOR CIRCLES.

BY JOHN W. WHITFIELD HARLAND.

A GREAT inconvenience arises in drawing upon wood blocks which are $\frac{15}{16}$ of an inch in thickness, owing to the absence of a rest for the hand and the difficulty in using squares (T or set) in drawing accurately perpendicular and horizontal lines, a difficulty still increased when drawing architectural or other subjects to perspective points where great care and accuracy are requisite.

To obviate these drawbacks and ensure ease, convenience, and extreme truth of drawing the writer designed, made, and used a board, which has stood the test of twenty years' use most satisfactorily, not only for wood but for drawings on paper, if to a very small scale, the paper of course mounted.

First make a $\frac{3}{4}$ in. drawing board A clamped at ends 24 in. by 15 in. over all, and plant upon it a 1 in. strip B, 4 in. wide, 24 in. long, glued and screwed from the back, with

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a groove ploughed in its face ½ in. from edge, of a dovetail form (see *a* in section) and rebated ½ in. by ½ in. on its upper edge, next to A, so as to leave a soffit of $\frac{1}{16}$ overhanging ½ in. beyond where the rebate is jointed on A, Fig. 1. To the right-hand side of drawing board A fit and plant on with glue and screws a strip C of 1 in. stuff, 6 in. wide, 11½ in. at back, rebated at one end to 11 in. long at face so as to fill the rebate in strip B. Note that this strip must be made absolutely

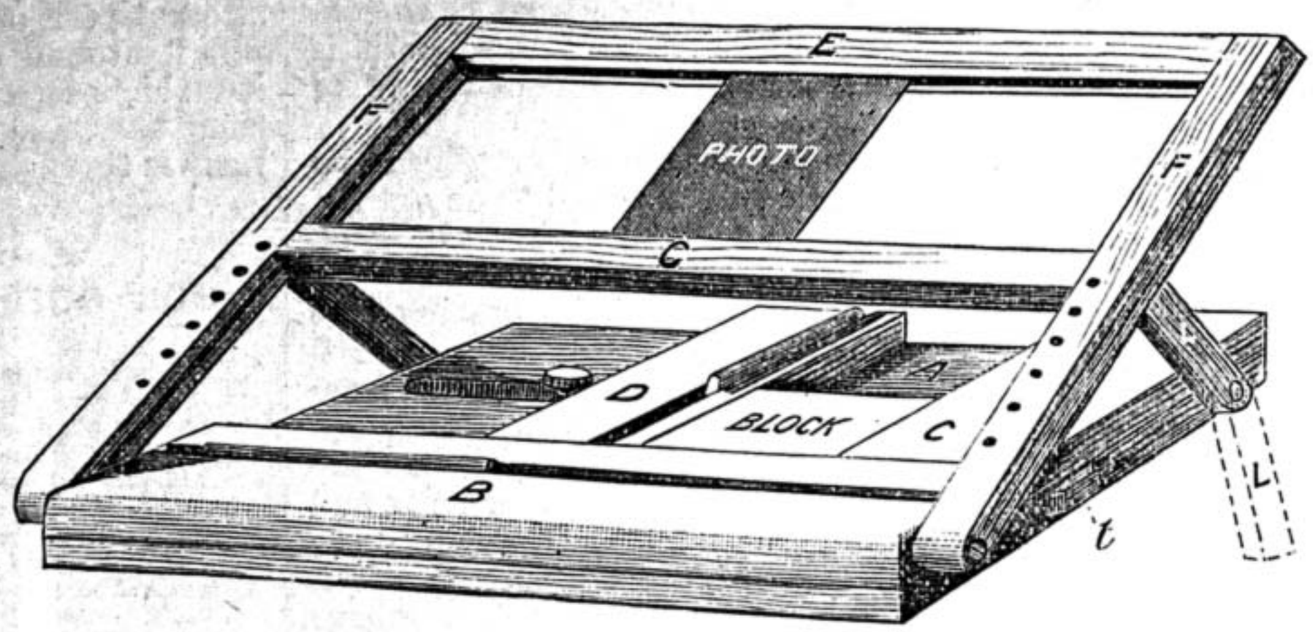

Fig. 6.—Perspective View of Drawing Board: open.

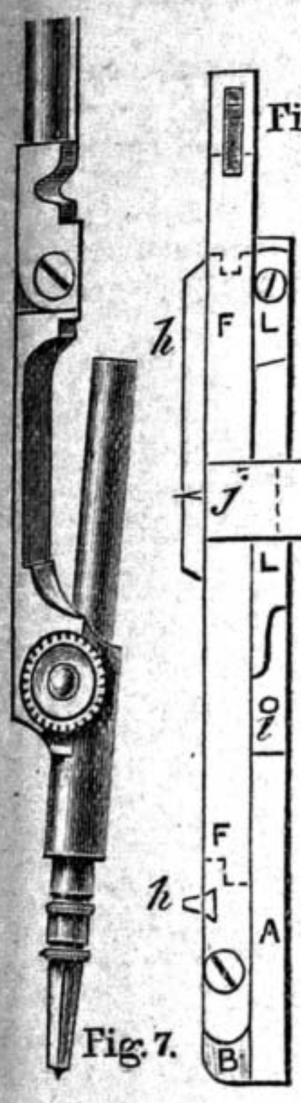

Fig. 3.

Fig. 7.

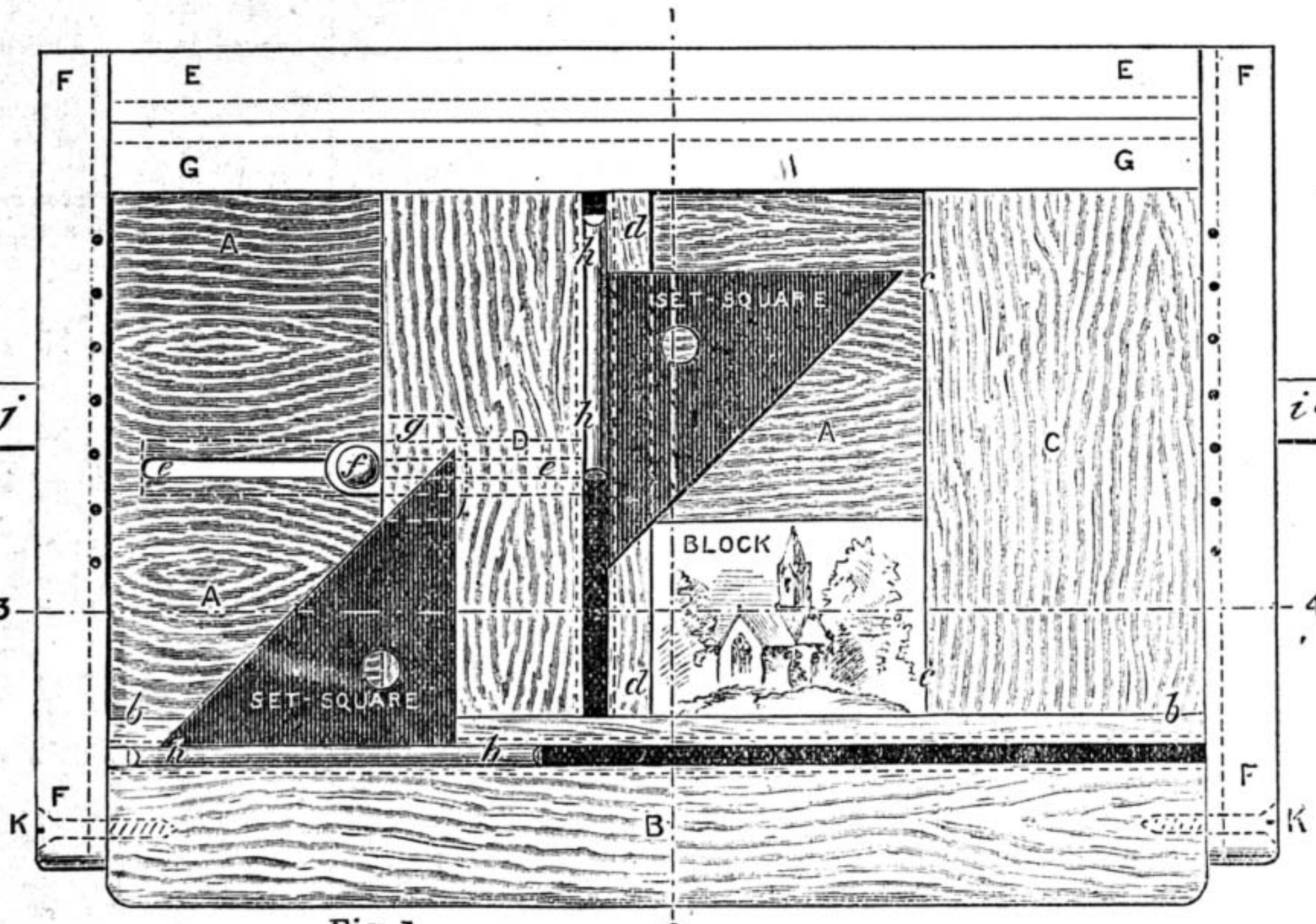

Fig. 1.

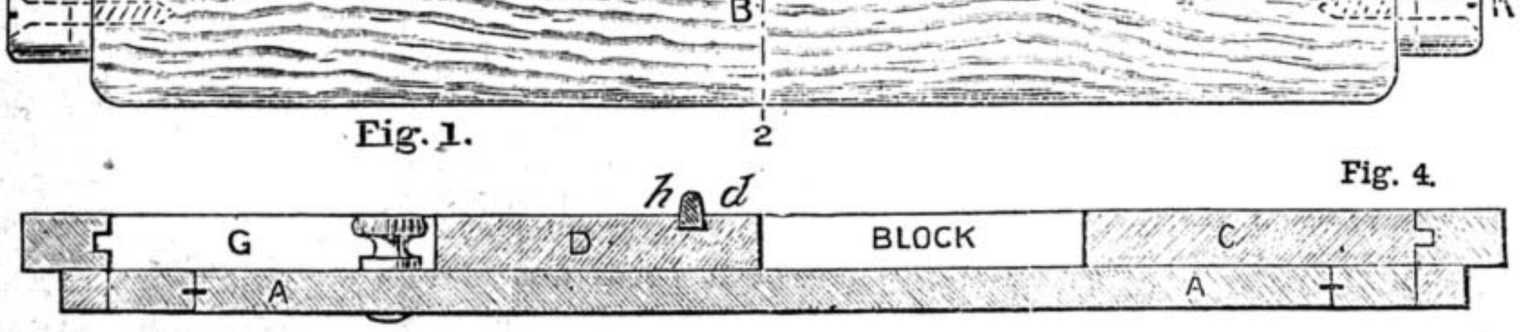

Fig. 4.

Fig. 1.—Plan of Drawing Board for Draughtsmen on Wood. Fig. 2.—Section of Drawing Board at Centre Line 1 2 in Fig. 1. Fig. 3.—End View. Fig. 4.—Section through Line 3 4. Fig. 7. —Propelling Pencil-Case for carrying Leads. Fig. 8.—Split Tube for Faber's Leads.

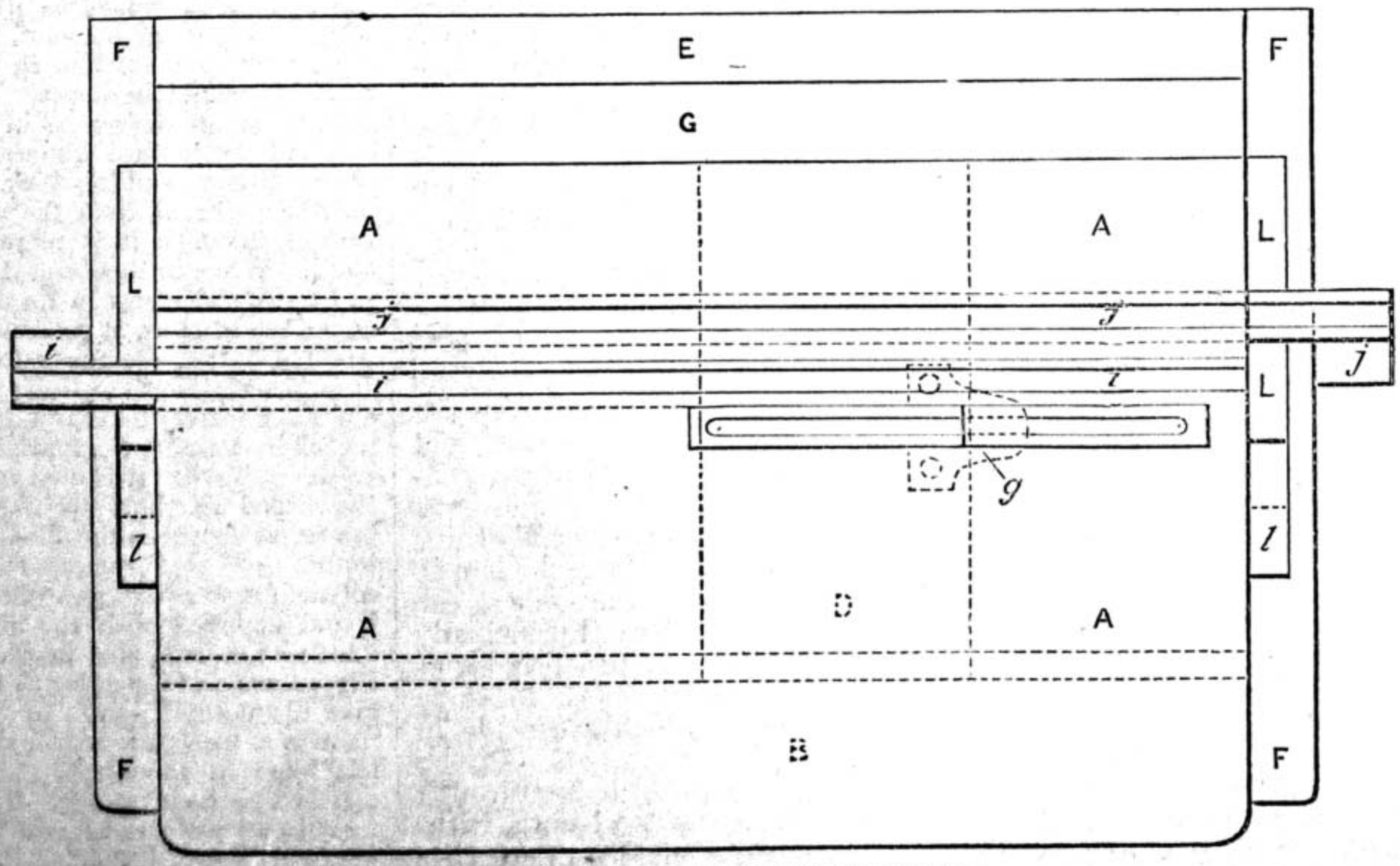

Fig. 5.—Plan of Drawing Board: looking up.

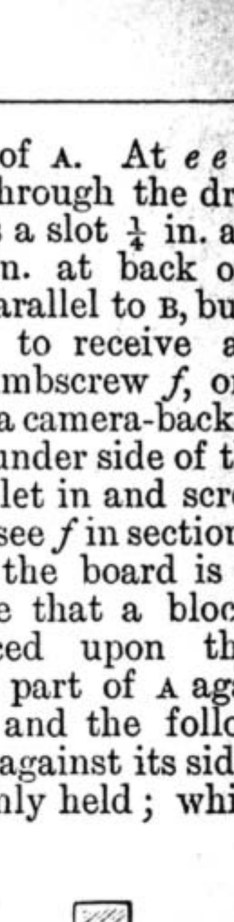

Fig. 2.

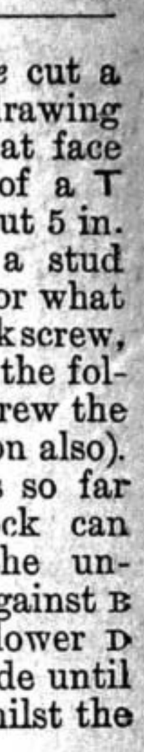

Fig. 8.

portion of A. At *e e* cut a groove through the drawing board as a slot ¼ in. at face and ½ in. at back of a T shape, parallel to B, but 5 in. from it, to receive a stud and thumbscrew *f*, or what is called a camera-back screw, and on under side of the follower D let in and screw the plate *g* (see *f* in section also).

Now the board is so far complete that a block can be placed upon the uncovered part of A against B and C, and the follower D pressed against its side until it is firmly held; whilst the thumbscrew secures the follower in its place, the surface of the block will be flush with the surfaces of B, C, and D, thus fulfilling the first condition: convenience for the rest for the hand of same level as the block itself. Now fit exactly to the dovetail grooves strips of wood (boxwood for preference) of the section shown at *h*, Fig. 2, respectively 9 in. and 6 in. long, made so accurately as to slide readily but not loosely in the grooves (see *a* in section). Having fitted these slides *h*, *h*, which stand up ⅛ in. above the level of the block, they can be slid along and used as *straightedges* for set squares to slide against, the longer one giving perpendiculars, in the

square with B, or more explicitly with the edge *b* of B, *c*, the edge of C, forming a perfectly true right angle with it.

Next fit a similar piece of 1 in. stuff of same dimensions D, henceforth called the "follower," so that it will correctly fit the rebate of B, and its edge *d* made perfectly square with *b*. Half an inch back from its edge *d* plough a groove parallel to *d* ¼ in. deep, ¼ in. wide at top by ⅜ in. at bottom exactly as groove before mentioned (at *a* in sections). This strip must *not* be glued or screwed, but is utilised as its name, follower, implies to slide square with B all along from the edge of C, also square to the full extent of the uncovered

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groove in B, and the other, horizontals in groove in D, with a right-angled set-square, but when not so required they may be pushed along their grooves out of the way of the hand when drawing.

At any point on the horizon of the required perspective where the vanishing points fall, a needle may be driven into the strip C and the follower D, and all vanishing lines can then be drawn with a straight-edge to these points with microscopic accuracy, the slides being pushed out of the way and pushed back again when vertical or horizontal lines are required; the width of strip and follower, 6 in. each, being ordinarily sufficiently distant for the vanishing points. In certain instances this is not the case, however; the writer, therefore, provided and fixed (see plan Fig. 5, "looking-up") two sliding strips, *i i*, *j j*, dovetailed into dovetail grooves in back of A (which can be taken out and hung up when not in use), having a thicknessing piece at their outward ends glued and screwed on with a fixed point or needle in each, so placed as to be in the same horizontal line.

As the horizontal line varies in various drawings, its distance should be first ascertained, and the block to be drawn should be pushed up to the fixed horizontal line of these sliders, and the vacuum, so to speak, between base line of block and the edge *b* should be filled with a strip of boxwood block of the exact size to maintain the block to be drawn in its right position with its perspective horizontal line coincident with the normal one of the board. The sliders being drawn out to the required distance on each edge, ought to remain in position through accuracy of fit, but as wood shrinks in time, and they may thus become looser, and thus be apt to slip, the sliders may be marked with inches and eighths like an English rule (or centimètres, dixièmes, etc., on the French decimal scale of lengths, which we like better), and when the point is found a note can be made of it, to check any subsequent shifting. By this means, before photography and process work came into vogue, the writer has produced for *The Builder* perspective architectural drawings which for accurate detail have not been surpassed, an accuracy due entirely to the means employed. A careful tracing put down on the wood gets obliterated in the shading-up in Indian ink and its exact angle is lost, but if the vanishing point is there it can be regained in the ruling up with mathematical precision.

But the draughtsmen on wood—artists, perhaps we ought to say nowadays—have not only to draw upon wood, they have very frequently to trace from very indifferent photographs, which is best done by light being transmitted through the print or glass photo on to the tracing paper. Our drawing board affords convenient means of doing this in the following manner. Make a frame of 1 in. stuff, $1\frac{1}{2}$ in. broad (see Figs. 1 and 4), 24 in. inside measurement, tenoning one piece of the side E into the two ends F, F, which are 15 in. long. Before gluing up into the mortises cut in ends, plough a $\frac{1}{4}$ in. by $\frac{1}{4}$ in. groove about $\frac{1}{3}$ in. from face in the four pieces of frame, and then make the fourth a sliding piece G, to fit the groove accurately, so that it will move therein to any desired position; then glue up and wedge the end pieces and the tenoned side E; when dry and finished off, slide the sliding piece G into it. At K, K, in F, F, bore screw holes countersunk and screw into the ends of B, so that when level with face of block, the strip C and follower D shall at their top ends be in contact with the inner edge of G when it is pushed close up to the tenoned side of frame E.

These screws form pivots, or hinges, on which the frame can be raised to any angle, or allowed to remain flush with top of block and board.

In the frame ends F, F, holes passing into the grooves in which the sliding piece G moves should be made every $\frac{1}{2}$ in. or so from $3\frac{1}{4}$ upwards, so as to maintain G in place with a photograph covered with tracing paper, or glass plate, with a paper print and tracing paper mounted upon it, put into the grooves of E and G (see section, Fig. 2), which will hold it whilst being traced, a mirror being put at the proper angle behind it to reflect the rays of light through it, the frame F E F G being inclined to a convenient angle to the plane of the board supported by the following means.

The top of the frame F E F G should be, when *down*, flush with the surface of the block, *i.e.*, with the surfaces of B, C, and D; when *up*, at a convenient angle, say, for instance, 45° or 50° to these surfaces or planes. By making two strips of wood L, L, with screw holes bored and countersunk at one end, and screwing them on to the sides of A below the frame which is screwed to B (see end view, Fig. 3), leaving them 9 in. long, and putting screws, in position shown, into A to form pivots—support for the frame F E F G is at once provided in the position shown in the perspective view, Fig. 6. But these pieces or levers, when not in use, would fall on their pivots; we halve them at their ends, as shown, and save the pieces so cut away—to plant on to A with a single screw each, in the same places they would have occupied had they *not* been cut off. The levers L, L, when not in use, are thus locked in their normal places by these "frogs" *l*, *l*, but they are capable of another use, namely, that of forming hind legs as it were to slope the drawing board to a suitable angle when blocks are being drawn (see dotted outlines in perspective, Fig. 4).

Having now completed the construction, we may add to its perfection as a "tool" by rounding the edges of B, so as not to fray the sleeves or irritate the wrist as shown in the drawings, and add to its appearance by polishing it with French polish or oiling it with raw linseed oil; or the parts where friction exists may be rubbed from time to time with powdered talc (pudding-stone), the French chalk of the oil shops, the bootmaker's, or the glover's.

Whilst on the subject of drawing to fine scales, probably we may usefully suggest simple means of keeping the radius of compasses always the same with pencil as it is with pen, the pen never wears away; the graphite gets shorter with every circle turned. Instead of using a lead-pencil cut to a diameter suitable for the holder in a pair of compasses, procure a propelling pencil-case (see Fig. 7) and break away the outer case; this costs but a few pence, and will save hours of time wasted in sharpening leads and altering the legs. You have only to propel the lead further out, by turning the nose-piece, to always keep the length of the leg of the compasses the same as the other leg. Another plan, useful principally for bow-pencils and spring pencil-bows, is to obtain, or make, split tubes to carry Faber's movable leads, which are made in all degrees of hardness (Fig. 8). As the lead wears it may be pushed further through the carrier and always kept to length, without altering the angle of the legs. Another alternative is to gum a strip of paper and roll it around a piece of Faber's lead until it is thicknessed out to fit the carrier of the compasses, and keep pushing it further and further through as the graphite wears away.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

36.—HARGER BROTHERS' "ALPENSTOCK" CAMERA STAND.

MESSRS. HARGER BROTHERS, of Settle, Yorkshire, have recently added to their large stock of specialities for the amateur's use a Camera Stand, which not only serves as an excellent and serviceable tripod for the support of the photographic

Harger Brothers' "Alpenstock" Camera Stand.

tourist's camera when taking sun pictures of the most noticeable views and objects in the country through which he may be passing, but also as a stout and strong, but not too heavy, staff or alpenstock to assist him in ascending hills and climbing mountain slopes. It may be regarded, indeed, as an assistance in walking generally, and will enable those who use it to dispense with the ordinary walking-stick. Its construction may be gathered from the accompanying illustration, in which it is represented as an alpenstock. When in this form it measures 4 ft. 8 in. in length, and varies in its diameter from $1\frac{3}{4}$ in. at the top to $1\frac{1}{4}$ in. at the bottom, weighing from 2 lbs. to 3 lbs., according to the size required. It is furnished with a strong spike at the bottom, and has a leather hand-rest at the top, which is useful in enabling the tourist to keep a firm grip on the staff when it is used as such. The legs of the tripod are held together by three leather braces, as shown in the illustration. When it is to be used as a camera stand, the braces, or collars, are removed, and when the brass top or tripod supplied with the alpenstock has been fixed on the brass pins in the top, the braces are slipped one on to each leg as far as is requisite to give the needful grip. In the hand-rest brace there is a space, the proper size for this purpose, left loose in the strap. The camera is then attached to the brass top. The price, complete, for a $\frac{1}{4}$ or $\frac{1}{2}$ plate camera is 10s. 6d.; and for a whole-plate size, 12s. 6d.

THE EDITOR.

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SHOP:

A Corner for Those who Want to Talk It.

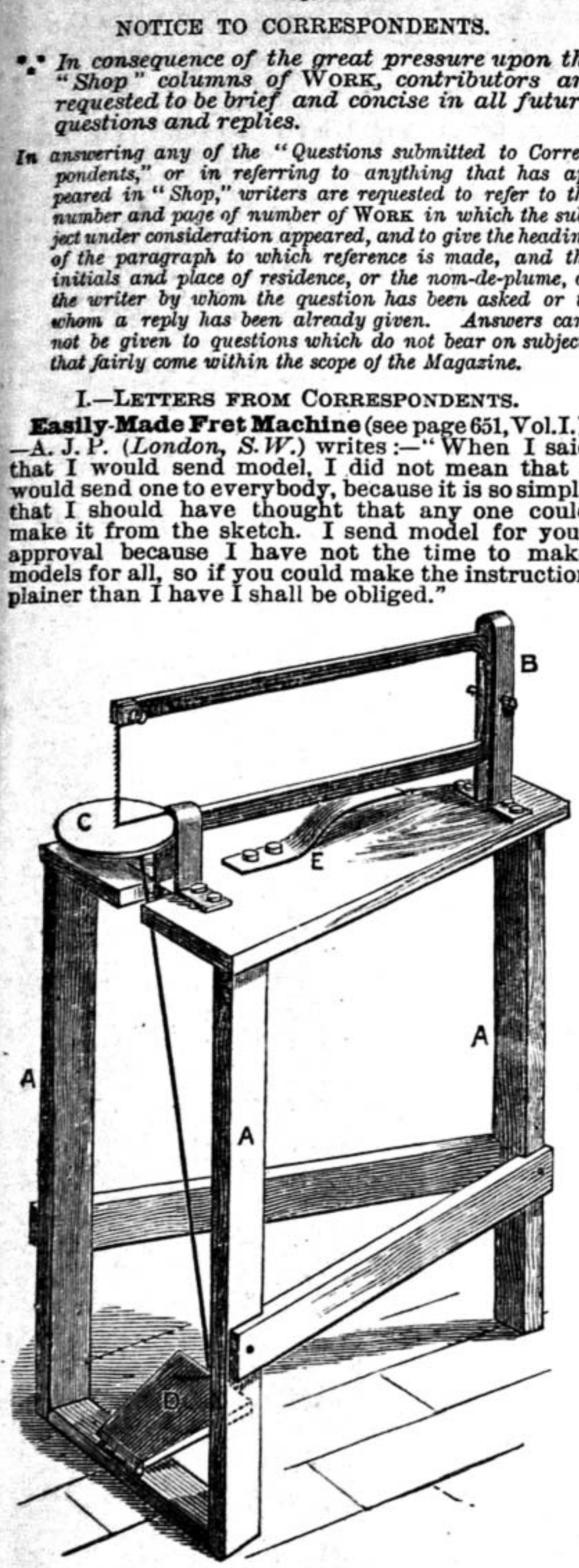
NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Easily-Made Fret Machine (see page 651, Vol. I.).—A. J. P. (*London, S.W.*) writes:—"When I said that I would send model, I did not mean that I would send one to everybody, because it is so simple that I should have thought that any one could make it from the sketch. I send model for your approval because I have not the time to make models for all, so if you could make the instruction plainer than I have I shall be obliged."



Easily-Made Fret Machine.

[The above illustration has been drawn from A. J. P.'s model, and it is hoped it will prove useful to our readers.]

Mandrel for Lathe.—The Britannia Company write:—"In reply to J. T. (see page 159, Vol. II.), there must have been something special about the mandrel to cost 30s. We should like to hear again. Our charges are always based upon small profits. Such an article as a mandrel, if forged and made special size, and hardened, and then carefully trued after the usual slight warping, may very likely be cheap at 30s. There is no telling what else belonged to the estimate." [Such complaints as those of J. T. should not be lightly made. Whenever it is thought desirable to call the charges of any firm or any maker in question, full particulars should be given. As the Britannia Company gently and justly hints, there are mandrels and mandrels, and that which would be a fair price for a good and carefully made article would be too much for one that was less elaborated and required less labour.—Ed.]

Griffin's Fret Saws.—Messrs. Charles Churchill & Co., Limited, 21, Cross Street, Finsbury, E.C., write:—"We have had three applications to-day (June 2) from parties who state that they 'see by WORK that we sell Griffin fret saws at 3d. per dozen.' Kindly make announcement in your next issue that your correspondent was misinformed. The price is 4d., and will not be reduced."

Mandrel for Lathe.—G. L. B. (*Bridport*) writes:—"I see in page 152, Vol. II., of WORK, an amateur asks where he can get engineering work done well at a nominal price. I have had good work done at a very cheap rate by Mr. G. Hounsell, South Street, Bridport."

II.—Questions Answered by Editor and Staff.

Carving Patterns.—A Carver.—I am not aware that there is any one who makes a speciality of casts for carving from. Patterns are hired out by the School of Art Wood Carving, South Kensington, to the manager of which you might apply. Rogers does the same from his studio in Maddox Street, W. Look round the Italian plaster cast shops. Your fellow carvers might sell you copies of any casts they have or allow you to take them.—D. A.

Electric Light.—R. H. (*Birmingham*).—It has given me pleasure to help my fellow workers in making their own electric bells and time alarums. I feel equal pleasure in being able to warn you against wasting your money in electric lights. In my forthcoming series of articles on "Model Electric Lights," you will learn all you wish to know respecting the cost of a small installation. Money spent in this way for the sake of amusement, or to gain an insight into the mysteries of electrical science, is money well spent; but the value of the light thus obtained is very small indeed. To prevent disappointment, I have clearly told my readers what to expect, whilst showing them how to satisfy their desires at the least possible cost.—G. E. B.

Watches.—J. C.—A half chronometer is a combination of the lever and chronometer escapements; but there are so many combinations, that unless you know somewhat of the escapement you had better entrust the purchase to a friend who does. I am afraid by writing I could not make you understand the difference between them all, as there are plenty of watches advertised as such that are simply frauds; for instance, some have simply a compound balance, that is to say, an imitation of the chronometer balance with a few screws stuck in round the rim, and that is sold often as a half chronometer; then some go still a little farther and cut the balance: then, again, a little farther, and put a genuine compensated balance; others, still farther, with a compensated balance and free hairspring; still again, compensated balance and Breguet hairspring; so that you will see there are half chronometers *and* half chronometers in all their varieties in the balance and hairspring only, with touching the vital part, the escapement; and, therefore, I can only repeat be careful what you buy and *where*. If you do not know any one you can trust to buy for you, go to a good maker like Dent, Strand, tell him what you require, with the price you are prepared to give, and you cannot go far wrong. The price you name I do not think you could get a thorough genuine one for, but you certainly would have a thorough good lever watch which with care would give you every satisfaction. The difference in price of the lever watches is solely in the finish. The actual cost of a wheel is very little indeed, often a few pence only. For a thorough good gold lever give about £30 or £35 at Dent's, and you will have the time, say, to a minute, or at most two, in a year. A Kew certificate is given with those watches that have been sent to Kew Observatory to be rated, and have passed satisfactorily.—A. B. C.

Index and Bookcase.—G. M. (*Berlin*).—An Index to Vol. I. of WORK can be had of any bookseller for 1d. Sketches and working drawings of a revolving bookcase have appeared in No. 48 of WORK.

Boiler Deposit.—W. S. T. (*Edinburgh*).—Water contains carbonate of lime and sulphate of lime in more or less quantities; and according to whether there be much or little, the water is termed "hard" or "soft." When boiled, water distils off pure as steam, leaving the lime salts deposited in the boiler as an incrustation or "scales." The carbonate of lime can be removed before boiling by stirring up some lime with the water, when the lime causes the carbonate to separate out; and after standing at rest for some time, the water can be drawn off the sediment. This is termed Clarke's softening process; but although it removes the carbonate of lime, it does not affect the sulphate, of which there is no practical way of getting rid. The best plan is not to do as above, but to put a handful or so of common washing soda into the boiler, when you will find that, although scales are formed as usual, they are soft and very easily removed, not requiring the scraping so injurious to boilers. There are "boiler-fluids" sold for putting into boilers, but they chiefly consist of a solution of soda. Some add sugar or tannin with the soda, but no advantage is gained thereby. Lead and copper pipes would be affected in the same way as those of iron.—F. B. C.

Polishing Drawers.—W. (*Alyth*).—You must first clean off all the varnish and then repolish in the usual way, except that you will probably be able to dispense with filling. I think you will find that you can remove the varnish more easily by scraping than by papering. If you are very careful you might wash off the varnish with soda or potash and water, but I hesitate to recommend you to adopt this course, on account of the liability to injure the wood.—D. A.

Fret Machine Fixture.—F. N. M. (*Keighley*).—Of course, if you fasten up your arrangement so that it is legally a fixture, it would become the landlord's on your removal from the house. If you are in doubt, why not see the landlord about it? If he is a decent sort of fellow, he will probably not object to allow you to fix up the machine and take it away, as it is hardly likely to be of much value. Fasten it up with screw nails, and then you can easily take it down without saying anything about it.—D. A.

Reading Desk for Bed.—M. A. (*Nottingham*).—The ordinary bed table is so suitable for your needs that I shall describe it. Fig. 1 shows the article. It can be adjusted to any height, and, as it is longer from the pillar to one end of the table than it is from it to the other, one half is allowed to pass over the bed when it is pushed to its side. By having two loose flaps it matters not on which side of the bed it is placed, as it will afford the required use in either way. Convenient sizes will be as follows:—Height of pillar proper, 24 in.; length of top, 30 in.; width of top, 15 in. If the top consists of a bottom board framed to a top board, with the latter divided into three pieces, the space between them will form a handy place for an odd book or two, etc. The pillar might be 4 in. thick, and a thinner one, square in section, will work freely up and down it inside. The inner pillar might penetrate the bottom board and be joined to the top board; or else fastened to a stout block of wood, and then that block and it joined to the bottom board. In the latter case the afore-mentioned space will be of more service than it will if the former method is adopted. The shape of the bottom board is optional, but have a good stout piece of material on castors. The inner pillar is fixed at any height by means of a screw and rack, or ratchet. The table top-board is divided into three pieces; the two smaller ones each being about 12 in. long and 7½ in. wide. The

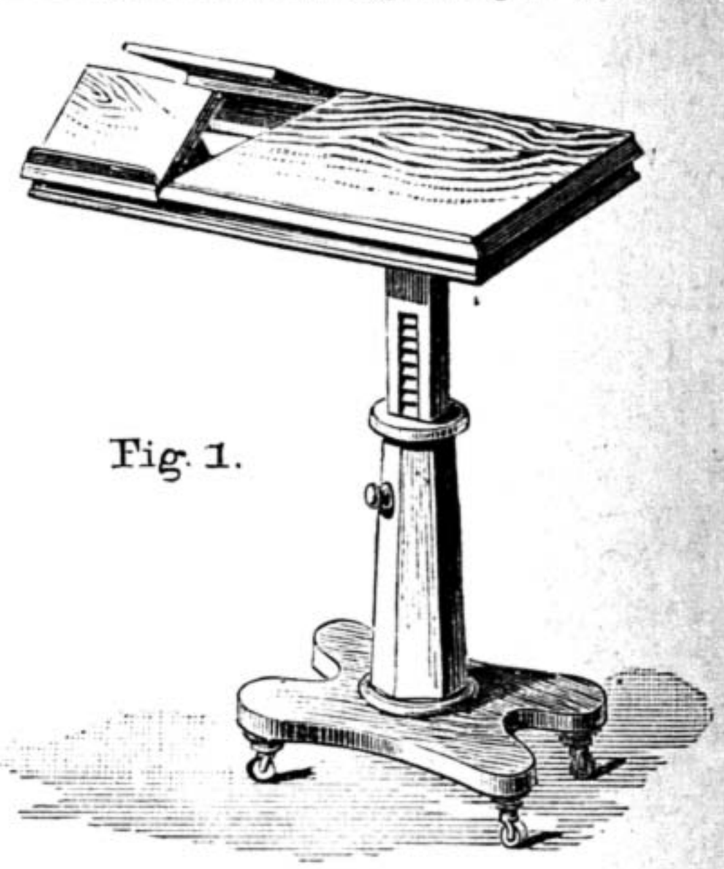


Fig. 1.

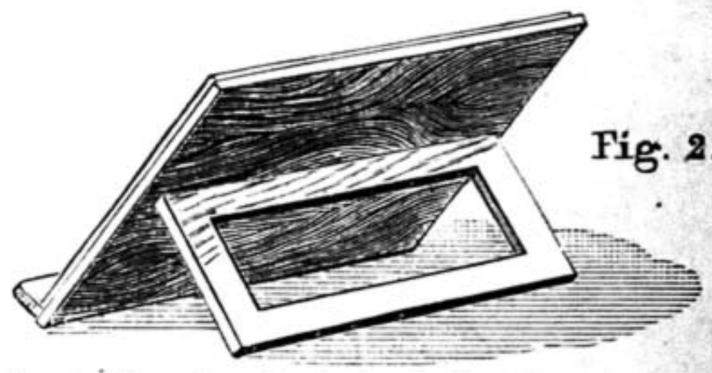


Fig. 2.

Fig. 1.—Reading Desk for Bed. Fig. 2.—Showing one of the Flap's support.

small pieces are each hinged to the framing, and have a narrow strip along the hinged edge to hold a book, etc. If a pair of music hooks are fastened to each of these strips, they will keep the leaves of the book down when it is open. A small mortised and tenoned frame is hinged to the under side of each flap, and will keep it at an angle. Fig. 2 gives an idea of these frames. The thickness of the top board might be ¾ in., the bottom board ½ in., the depth of the framing 1½ in. or 2 in.—J. S.

Lantern Slides.—P. J. (*Islington*) asks where rack-work for revolving lantern slides may be procured. In a general way, they may be obtained of any manufacturer of lantern appliances. I can, however, give P. J. a list of prices from Messrs. Lancaster, Birmingham, which list does not appear in their catalogue but which I have obtained privately. I would here say, with the Editor's permission, that if it will be of any advantage to any reader of WORK, I will undertake to supply any optical appliances at catalogued prices. By this means time will often be saved to the persons engaged on any instrument. Lancaster's prices are as follows:—Double rack-work for chromotrops, 3s. 6d.; single racks, etc., for levers, windmills, etc., each 2s. 6d.; wave slides, 2s. 3d.; levers, with glass in each, 1s.; two rollers for snow effects, etc., per pair, 1s. 6d. All in brasswork only, no wood frames.—O. B.

Spinning Hair-Lines.—Spider (*Castle Douglas*).—For apparatus with which to spin hair-lines in the most approved fashion, Spider will have to go to Redditch, the headquarters of the fishing-tackle trade. Mr. W. J. Llewellyn, of the Wellington Iron Works, Redditch, will supply him with the machine he needs, as also with such information about working it as he may require.—M. M.

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Folding Chair.—M. H. (*Bristol*).—It would be a moral, if not a legal infringement to follow the lines of the chair you mention so closely, and yet not copying it, as to amount to the same thing; but to meet your requirements I have specially designed the one here shown (as you ask for a chair "like, if possible, the patent hygienic folding chair, No. 34"), which resembles the above-named chair no nearer than that does other chairs of the same character, with the exception of the rocker, the combining of which facility, in conjunction with that of folding, certainly entitles the inventor of it to credit, and I hope he will not consider that I am running too near it in meeting your wishes with the present design. It may happen, however, that this approaches too closely to some patented brother, although I do not think it does, as I have seen some dozens of different kinds, and always endeavour to avoid copying them. But if any reader has seen any chair which he thinks this too closely resembles, I would thank him to send notice of the fact, as "patent rights" is very dangerous ground to trespass on. I have designed one or two more of this class of chair, but, as space is limited, I only show one. I generally steer clear of folding chairs which may be said to represent a × breed (!), but as nearly all of them are patented, and the personal right of making one of them not allowed, perhaps, with the Editor's permission, I may some day give a chapter of a few designs, when, of course, no one will be precluded from making one. The scantling for this chair will be 1½ in. by ¾ in. thick. The longer

Fig. 1.

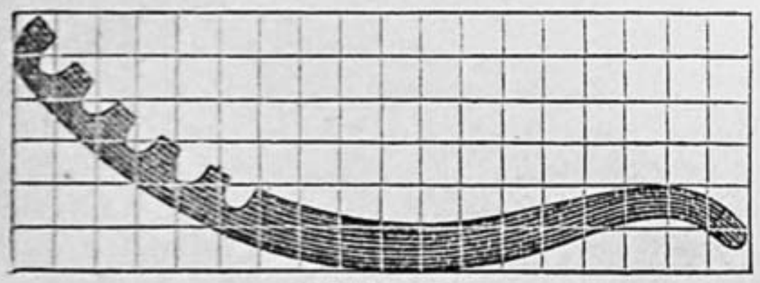


Fig. 2.

Folding Chair and Rocker.

sides will be 4 ft. 6 in. in length; the shorter ones 2 ft. 9 in.; the back connecting rails 2 ft. 2 in. Note, in my drawing, the position of the different rails; they are firmly pivoted together, with the exception of where they cross each other, and at the bottom end of the longer bars. Where they cross, the shorter ones are supported by the spindle between the longer bars. This spindle should be fitted at 15 in. distance from the bottom end of the longer bars—my drawing shows it hardly far enough. At 2 ft. 3 in. distance from the same part of the latter rails, is pivoted one end of the back connecting bar, the other end of which will be pivoted to the rocker. Also to the rocker is pivoted the bottom ends of the seat-bars. The rocker is the most principal and difficult part. From where the notches begin, to the front end of it, it *must* be an arc of a circle in shape, and the central point to strike it from will be at a little distance under the spot where the back connecting rails and the longer side bars meet. To make it more convenient for you to make it correctly, I have given Fig. 2. If you understand anything about scales, you will clearly comprehend this diagram, as it is drawn to ¾ in. scale. If, however, you do not understand, get your board or a sheet of paper, and mark the *same* number of squares upon it as I show, but each one of them 2 in. wide; you will then be able to copy it almost exactly. It should be a good strong rail, and might be 2 in. or 2½ in. wide at the front half. You must cut the notches in it rather deep. The width of the chair can very suitably be 18 in. I daresay you will understand how to fix the carpet; and also how the chair works.—J. S.

Upholstery.—F. E. (*Bath*).—I cannot name any positive date for the commencement of a series of papers on this subject, nor can I undertake to reply to questions bearing on what has appeared, or is appearing, in other serial publications.—ED.

Sandal Wood.—F. H. F. (*Kensington*).—This wood is imported from India and Australia, the former being the best and most expensive. Bombay wood can be bought at about 1s. 6d. per pound, the price depending upon the quantity wanted. The wood is hard and heavy, and is of an oily nature, but I should think it would work all right. It has a strong but pleasant odour, the Indian wood having more smell than the Australian.—A. J. H.

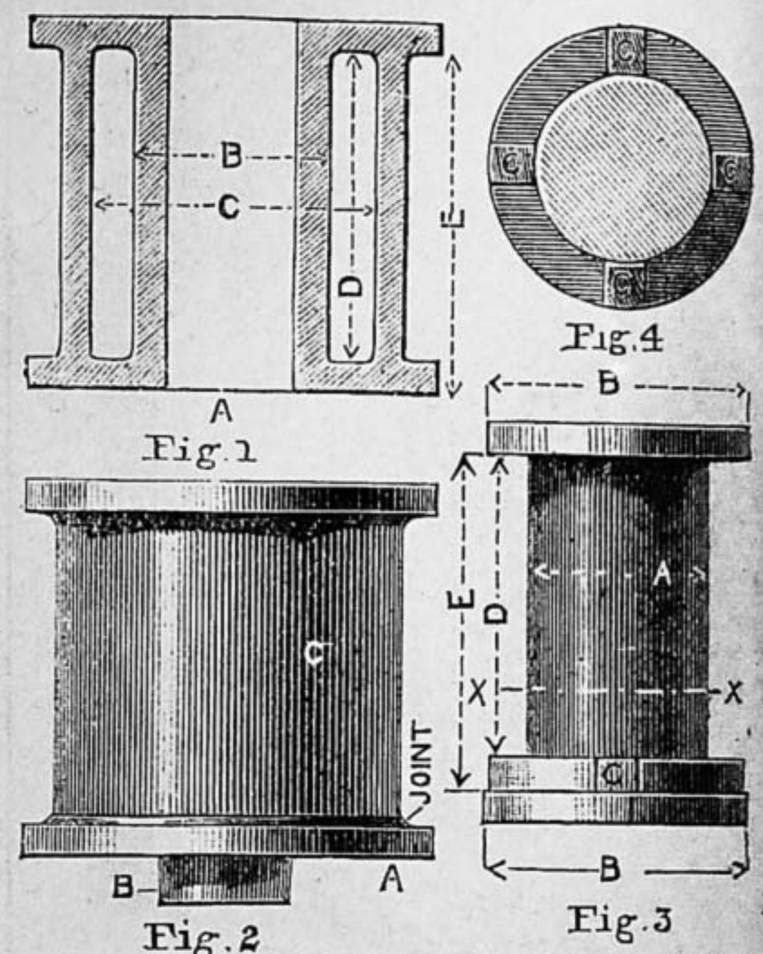
Telephone Matters.—E. W. (*Hurstpierpoint*).—It is a pity that you have not yet received an answer to your former queries, but no doubt you will, long ere this appears in print. You must understand that the space in "Shop" being limited, and the circulation of WORK so very wide, and the circle of correspondents so very great, some time must elapse from the receipt of a query until the answer appears. Yours reached us in due course, and I remember distinctly answering it; and your present questions are nearly all answered; however, I will just go over them now as they lie before me in your present note. The telephone companies will not annoy you in any way for having in your possession a pair of telephones like those described in WORK. It is quite true that the United Telephone Co. have bought up the patent rights of the Bell telephone, and you cannot set them up and use them for business purposes or purposes of convenience. I have already mentioned the *English Mechanic* receiver in WORK, and shown the difference between it and those already described. I could not give a sketch of a switch board in this column, as it would take up too much space, but I will write an article upon it, which may help you. The induction coil in certain instances is an improvement in telephone circuits. You need not trouble yourself about the composition of silicium bronze wire, as you could not make it, and besides, it is only used for extremely long distances, because of its excellent conducting capacity. I have never heard of "coppered iron wire," and I think you must be making a mistake about this. Anyway, good copper wire covered with cotton is all you want. You should read up the subject in some handbook.—W. D.

Wax-Ends.—R. W. S. (*Godalming*).—To make wax-ends for making or repairing boots and shoes, get a ball of hemp and a ball of shoemaker's wax, and some bristles from the leather-seller's. Take the ball of hemp in the left hand, and draw off with the right as much as you require to work with—say, from one yard to a yard and a half. Do not cut it, but place it down on your right knee, and with the palm of your right hand roll it over from you till it untwists and will break off easily, leaving two fuzzy ends. Place these two ends together, and draw off another length, breaking it off in the same manner. Repeat this operation till you have got as many strands as you require. Four-fold is generally sufficient, but it depends on the size of the hemp and the work to be done. If you have broken off your hemp in the way described, you will have each end tapering off to a fine point. Now wax it well from end to end. Hold one end in the left hand, and twist it well by rolling over from you on your right knee, giving the ends a few extra twists and strokes of wax. Take the two ends in your left hand, and hook the middle over a hook or nail, and rub it till smooth with a soft piece of leather. This rubbing melts the wax into the hemp, and prevents untwisting. You have now a strong four-fold thread of well-twisted and waxed hemp, with two finely-pointed ends, to which you must attach bristles. Taking one in your hand, you will observe the one end is split into three parts; open the splits about one inch more, and, holding them apart with the thumb and finger of your left hand, insert the fine point of the waxed thread between them, and with the thumb and finger of the right hand twist two fibres of the bristle round the waxed end until firmly united. Place it between your third and fourth fingers to prevent untwisting. Take hold of the single fibre of the bristle, and twist that also. Now let the two twist together, which is done by the thumb of the left hand. The fine end of the waxed hemp is now firmly fixed and twisted in between the fibres of the bristle, and this is the secret of making a wax-end. To finish, you make a hole with a pin or fine awl in the thread half an inch from the split end of bristle, and insert the point of the bristle, and draw it through. This fastens it off, and prevents the fine ends from getting loose. Nip off the point and it is ready for work. Of course, you fix a bristle on each end.—J. M.

Furniture Frames.—SPOT (*Gosforth*).—I suppose you want suites of frames for upholstering. If you are in the trade you must use your own discretion as to which house supplies them "best and cheapest." It is useless for me to give names and addresses, as no doubt you are acquainted with wholesale houses. They generally let their existence be known to those with whom they wish to do business. If you are not in the trade, the names of wholesale houses cannot be of any legitimate use to you, and you can easily get what you want through a local upholsterer. I am reticent about names, as you may be one of that large class who think they can be clever enough to buy retail lots at wholesale prices. If I am mistaken let us know, and I may help you further, though WORK is not a "trade organ."—D. D.

Shock from Leclanché Battery.—MANCUNIUM (*Manchester*).—You would not experience any shock or any sensation in the nerves from taking hold of the wires leading from a small Leclanché battery. It is useless trying the battery that way. Either test it practically by connecting it to the bell, or to a galvanometer. If you cross the tips of the wires on the tip of your tongue, and then slip one off the other whilst on the tongue, you will probably experience a slight shock in the nerves of that member.—G. E. B.

Water Jacket Cylinder Pattern.—CORE BOX.—Fig. 1 is a section of your casting, Fig. 2 the pattern, and Fig. 3 the core box. In the pattern, A is the bottom flange, B the print for the central hole, A, in Fig. 1. The flange and print are fastened together but left loosely dowelled to come away from the body C in Fig. 2, the pattern moulding with the flange and print in the bottom. In the core box, Fig. 3, the diameter A corresponds with the diameter B in Fig. 1, and the diameter B with the diameter C in Fig. 1. The core is rammed as an annular ring round A, and shickled off round B, and is stiffened with rods running the whole length and passing through holes drilled in B, B. Since you must get the air off your core, it is impossible to make the casting with both ends blank; you therefore make holes at one end to allow of the escape of air, and these holes have to be filled up afterwards in the casting with blocks of iron before the flanges are faced or the covers bolted on. In Fig. 3, C, C represent the provision made for these holes in the core box, and the lengths D and E of the core box, which correspond with the lengths D and E in the casting, are apparent in a comparison of Figs. 1 and 3. The four portions of sand at C also afford a support to the core in the



Water Jacket Cylinder Pattern.

mould in the absence of prints. But it is better to allow four of the longitudinal stiffening rods to pass right through C, and press them into the bottom of the mould, so that the core cannot shift under the pressure of metal. Vent holes are also brought down through C into the bottom of the mould. The holes C are filled up with cubical blocks, filed to a fit and rusted in with sal ammoniac. If the annular water space is wide enough, you could cast ¾ in. or 1 in. round holes at C, and screw and rust studs in instead of square blocks.—J.

Scrap Screens.—H. B. (*Kettering*).—Your queries are so clear and pertinent that it is a pleasure to answer them. (1) The best foundation, I have found, is either an unbleached calico, that shrinks after being wet (this should be proved before using), or American oil cloth, self-coloured. If the former, then paper should be pasted on when the calico is strained in place. If strong paste be used, and rubbed well into the calico, as well as applied to the paper, the chances of its rising in blisters, that you dread, are practically absent. (2) Personally, I dislike intensely a black ground, especially if black and white prints are to be used. There is a good royal red American cloth, that looks well with coloured scraps; and a dull sage-green, or a dull terra-cotta paper, is pleasanter than black. If black and white prints, then no mixture of coloured prints; if coloured, no black and white, is to me an inflexible rule, that, if it be broken, means certain failure. Used with judgment in an all-over design, with the background of some cut away, but no actual ground showing through, the coarseness of the black sackcloth you mention would, I expect, be not only unsightly between the scraps, but make the sticking-on a labour and a penance. Plain dead-gold paper for coloured scraps is good, and I believe a plain gold American cloth—that is, a bronze colour, something near to gold—is to be had; but where, or at what cost, I know not. If the scraps are arranged, like a modern wall paper, with frieze-filling, band for chair-rail, dado, and skirting, the effect is good, and the separating borders of rich wall paper add to rather than mar the effect of the whole.—E. B. S.

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Portable Music Stand.—A GRATEFUL READER (*Glasgow*).—Do you really want a stand to extend to six feet?—that is very tall. You want it with pillar, so I have given you two pillars, as additional strength will be obtained by these; but if you only want one pillar, it is, perhaps, needless to say that it is only necessary to discard one of the two I show, and put the remaining one in the centre of the article. I have designed this stand so that it may be a very firm one when open, as in Fig. 1, and will fold up very flat, as in Fig. 2, without any one piece coming entirely apart from the others. I think I show the frame at the top as something a little fresh. The various pieces of music can be placed on the back frame in readiness for choosing any one piece to appear on the front one. If this is not desired, it can be used as a double stand. Fig. 3 shows the former adaption; Fig. 4 the latter (in section). The ends of the frames are shown in Fig. 11, and by means of these being pivoted to the cross-piece on top of the column blocks, the frames can be turned to almost any angle, and can be fixed as desired by means of a small hook. A small bracket is hinged to one or each of the top column blocks, and serves to keep the back frame up, or allow it to fall down. Each column works the same as a telescope. The two top slides should be 20 in. long, the bottom one 18 in. This latter should be square in section, because the feet will be hinged to both of them in such a manner that they will fold round to the back; and this can be accomplished better on a flat surface than on a round one. Fig. 8 gives a plan of the bottom part (which should be joined together by means of fretwork) with the feet folded round them. To keep the stand firm when extended, fix between the tops of each pair of columns a rail, which in section will be as Fig. 7. Before fixing these, slide into each of them two pieces of iron. Then cut the tops of the columns as in Fig. 10, and the bottom end (within about 2 in.) as in Fig. 9. Now fix the above-mentioned rails exactly between the holes in the tops of the columns. Thus, it will be apparent, when each pair of columns are drawn from the others, if the irons in the rails are pushed apart, they will pass through one pair of columns and fit into the notches at the bottom of the other pair. For better explanation, I have given Figs. 5 and 6, which show respectively the irons completely in the rails, and the ends of them pushed out. Brass tubing will be preferable for the columns. You will, doubtless, make the frames according to your requirements; but for the benefit of others, I think 15 in. by 10 in. would be suitable. And if any one else wishes to make this stand, I think he will have to reduce the height, for I daresay it will be found too high for most "musicianers."—J. S.

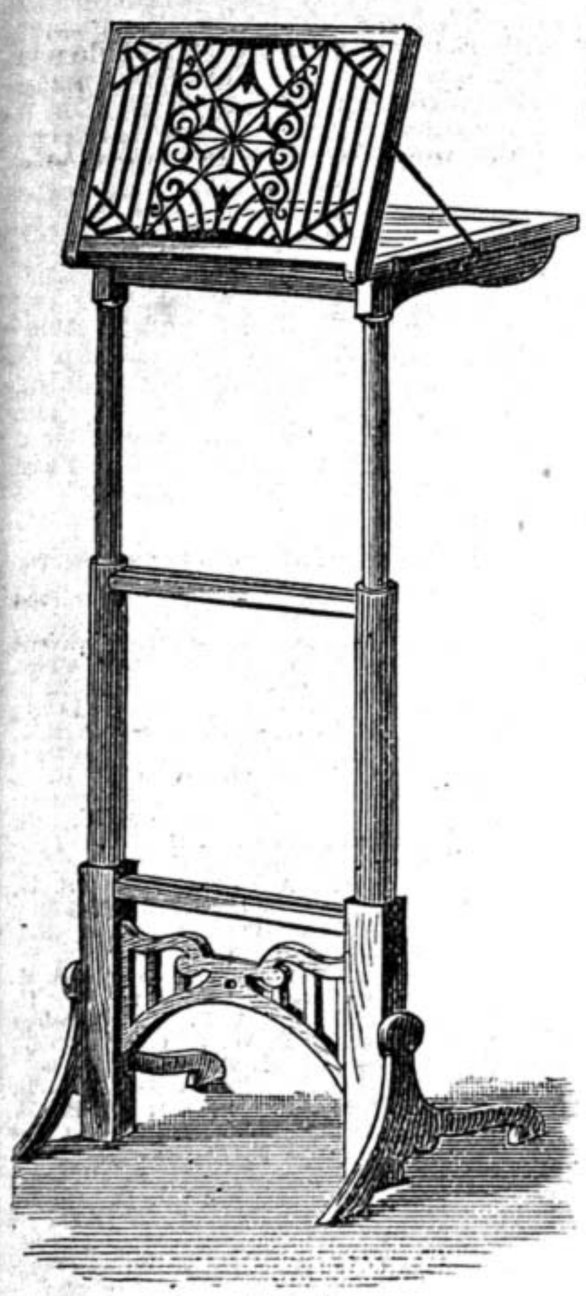


Fig. 1.

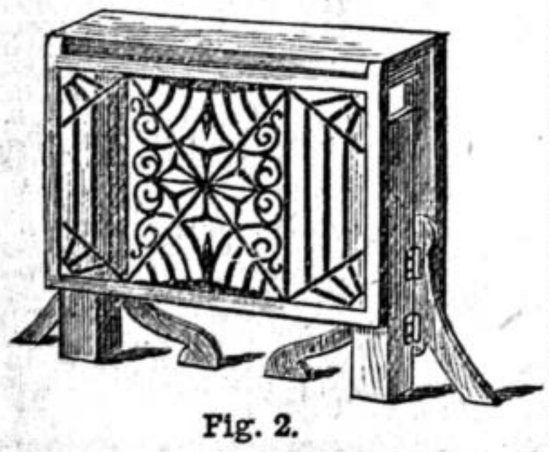


Fig. 2.

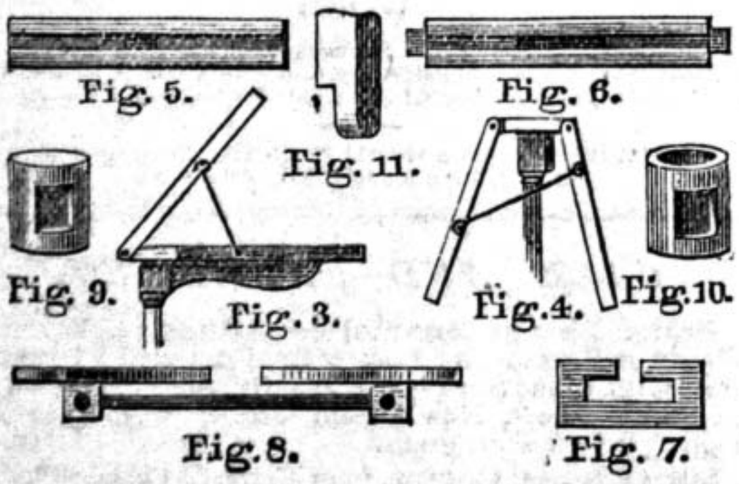


Fig. 1.—Stand extended. Fig. 2.—Stand closed. Figs. 3 and 4.—Frames up and down respectively. Figs. 5 and 6.—Cross Rails showing Catches in and out respectively. Fig. 7.—Section of Cross Rails. Fig. 8.—Bottom Part: plan. Figs. 9 and 10.—Ends of Columns (top and bottom respectively). Fig. 11.—Ends of Side Rails in Frame.

Bookbinding.—BOOKBINDER.—Articles on this subject have appeared in the following pages of WORK: 81, 110, 138, 220, 221, 253, 269, 285, 318, 365, 493, 494, 510, 572, 588, 590, 605, 651, 715, 716, 732, 779, 795.

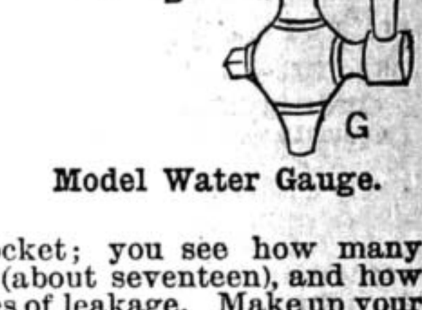
Making Cameras. — Detective cameras are made in very great variety, each claiming some special advantage. An ordinary ¼ plate camera fitted into a bag or box is a very workable form. The lens must have the focus fixed and the means of liberating the shutter on the outside of the bag or box. Why not write to the gentleman named and ask him?—E. D.

Acid and Gilding.—A PAINTER.—Glass embossing, or glass etching, is the process whereby certain portions of the surface of the glass are dissolved or eaten into by *hydrofluoric* acid. The parts of the surface *not* required to be acted upon are carefully painted in with a "stopping-out" mixture. Good Brunswick black alone will answer for experimental purposes as a stopping-out article, but to make it thoroughly reliable the addition of some 20 per cent. of dissolved white wax is advisable. A margin of wax or tallow is put round the glass to confine the acid, and, the stopping-out mixture being quite hard, the acid is poured on. As the fumes arising therefrom are dangerous to health, they must be avoided as far as possible. When the action of the hydrofluoric is completed, we pour it off and well clean with water. The stopping-out mixture is then removed with turps and soda water, or the latter alone will answer. The design is then "brought out" by grinding the surface with fine emery powder, which gives it an opaque appearance, and leaves the acid-eaten, sunk portion quite clean. This was the method usually adopted by glass embossers until very recently, when the introduction of a *white acid*, which will bite out and leave the surface opaque, has obviated the necessity for grinding. White acid is used in similar manner to the former kind. About half an hour is required for it to act, but both kinds should be tested for strength before being used, and if necessary, diluted with cold water to allow working them comfortably. In using white acid the *design* is stopped out, contrary to the method with hydrofluoric. They must, of course, be kept in gutta-percha vessels. Messrs. Wilkinson & Son, Attercliffe Chemical Works, Sheffield, advertise a sample pound of each acid and varnish, including gutta-percha bottles, forwarded on receipt of P.O. for 7s. 6d. This is a special line and worth the money. Doubtless the complete subject will be written upon in WORK all in good time. The canisters you mention are, I suppose, "show" articles at the grocers. Write with "japanner's gold size," and gild with "extra deep" gold leaf at about 1s. 3d. per book. For gold leaf, etc., write to J. Smith, 39 and 41, Bridge Street, Manchester.—DECORATOR.

French Polishing Bureau. — W. B. (*Bruntcliffe*).—Very likely, as you suggest, your bureau has been polished with beeswax; and if you are wise, you will not attempt to French polish it. However, as you intend to do so or die in the attempt, I feel bound to help you in order to save you from a premature end. The fact of the bureau being a larger thing than you have hitherto polished hardly makes any difference. If you have managed to do small articles you can do it, the process being the same. A larger surface has to be covered, and that is all. You must first thoroughly clean the bureau to get rid of the dirt which has accumulated. If the thing is solid you may wash it with a little soft soap or soda and water without much risk, but if it is veneered in parts, or inlaid, you must be careful not to make it too wet, for obvious reasons. Very likely a damped cloth will do all that is necessary. When washed, the bureau will look ugly. Do not be frightened—the colour will come back again when you French polish it. In the corners by the "cock" beading, the present unsightly appearance is probably owing to nothing more than an accumulation of dirt in those places which cannot be so easily rubbed clean. The only thing you can do when polishing such parts is to use extra care in working your rubber well into the corners. The brass handles should be taken off before polishing the wood. They should be thoroughly cleaned. If they have been lacquered, remove the old lacquer by soda and hot water. Polish brightly and relacquer, if you wish them to keep their brightness; if not, an occasional rub will remove tarnish. It is seldom that an amateur can manage to relacquer properly, but there is no reason why you should not try.—D. D.

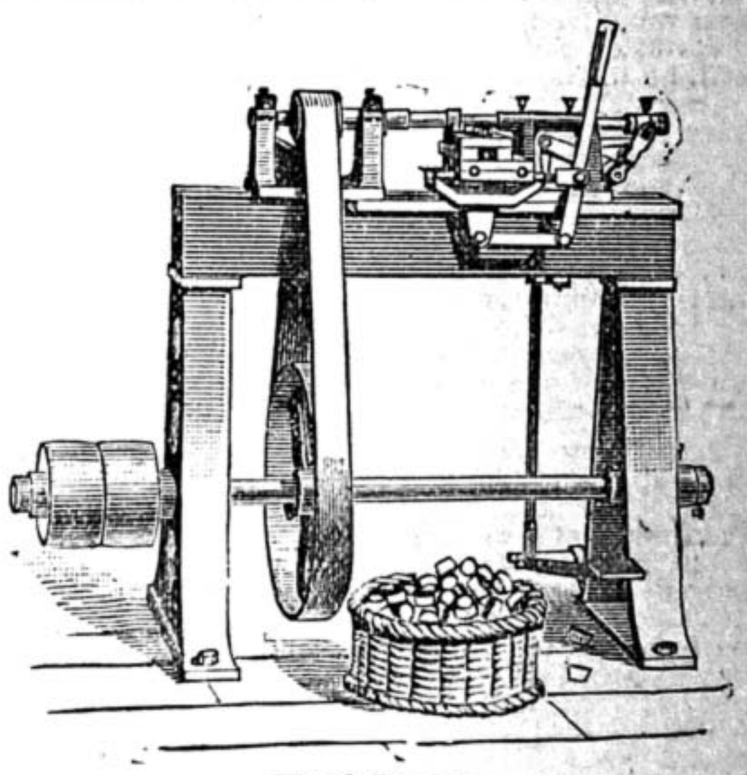
Polishing.—J. B.—You cannot do better than stain your bookcase a dark mahogany colour, which, you are doubtless aware, is very similar to rosewood, unless you are skilful enough to paint in the dark markings peculiar to the latter. From your letter it may be safely assumed that you are not, in which case an attempt to do so would certainly be a failure. Stain the wood with weak walnut colour, and polish with red polish. Make the stain with vandyke brown mixed with a little ammonia and water. The polish is ordinary French polish reddened with Bismarck brown. Read the previous answers in "Shop" to correspondents.—D. D.

Model Water Gauge.—YOUNG ENGINEER.—You will find this a troublesome job, and I think unless your boiler is of fair size you might be content with gauge cocks. Here is a tracing of a model water gauge from Mr. Lee's book, where its price is 7s.; you see it has three very small taps, and the glass is ⅜ in. diameter; it is therefore drawn to scale and is full size. Mr. Lee makes a smaller and simpler gauge for 4s., with ½ in. glass and no taps; but then if the glass should break you cannot shut off the steam. This is one of those things it is better not to have unless it is really well made; it would quite spoil the appearance of the boiler to have it leaking at the taps or glass, and it is sure to do so unless very well made. In the figure, A is a bit of wood or metal to represent the boiler; B, B, are little taps screwed into the boiler; C, C, are the sockets screwing on to the ends of the taps B, B; D, D, are the stuffing glands to keep glass from leaking where it is inserted; E is a little cap screw taken off to insert the glass; F the glass; and G the blow-off cock screwed into lower socket; you see how many small pieces there are (about seventeen), and how many joints and chances of leakage. Make up your mind, if you attempt it, to do it very well indeed, or you will have it leak.—F. A. M.



Model Water Gauge.

Wood Bungs.—READER (*Lynn*).—Below is a cut of the machine for making either the wood bungs or chives, and the spile pegs or vent pegs used for beer casks. It is the only machine I know of, and



Wood Bungs.

is by the eminent firm of Ransome & Co., whose cask machinery is superior to any others. READER will see at once that it is a form of lathe, and is fitted for the especial purpose.—B. A. B.

Japanese Materials.—F. C. (*Stockwell*).—Your screen queries will have been answered ere this appears; but your new suggestion as to crewel-work panels is, of course, admirable *if* you can get bold decorative work. I should mount such panel like an oil painting, and sink two back to back in a framing thick enough to contain them.—E. B. S.

Brooch Pins.—J. P. (*Reigate*).—Brooch tongues or pins made of German silver can be bought ready-made for a few pence per dozen, from any jewellers' material shop, such as Pringle, Clerkenwell Road, E.C., Gray & Son, Clerkenwell Green, E.C.; or Plucknett & Co., 29, Poland Street, and there are

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dozens of others in both Clerkenwell and Soho whose names you can find in the directory. If it is gold tongues that you are making inquiry about, then I strongly advise sending them to a working or manufacturing jeweller of good standing; or why not try and do them yourself, by the aid of the article in No. 41 of WORK, published December 28, 1889, and send to the jewellers' material shops for gold wire, chenier, solder, etc. etc.?—H. S. G.

Circular Saw Bench.—H. C. T. (*Newcastle-upon Tyne*).—Send particulars of this for "Shop," then C. W. T. (*Leicester*) and other readers besides will have the advantage of your contrivance.

Violin Wood.—R. P. (*Walkden*).—It is generally admitted that Swiss pine is the best wood for a violin belly. For the back, sides, and neck, sycamore or maple is chiefly used. The instructions you inquire about will appear in Vol. II. of WORK. If you ask questions on more than one subject, please do so on separate sheets; this will save time.—B.

Polishing Flower Stand.—J. H. (*Crewe*).—To polish your walnut flower stand, proceed in the usual way, which has been given several times in "Shop." Oil the wood if you wish to darken or enrich the colour. Use ordinary French polish, and, of course, before applying this, fill the grain with whiting mixed with a suitable brown colouring. Body up with the polish, and afterwards spirit off to get the gloss. To darken pine to walnut colour, use a stain composed of vandyke brown, mixed first with liquid ammonia and then diluted with water.—D. A.

Pantograph.—P. M. F. (*Falmouth*).—Particulars of this have already been given in the "Shop" columns of No. 42; see page 669.—D. A.

Overmantel.—DR. H. (*Askeaton*).—I am afraid an overmantel of peculiarly elaborate and splendid design, which shall be a *chef-d'œuvre* in the tall pointed Gothic and semi-ecclesiastical style, is hardly a thing which could be appreciated by many of our readers. Such a thing is not to be designed or thought out in a day, and I am not surprised at your having failed to get what you want from dealers in fretwork. Your best plan will be to get designs prepared by some good furniture designer, or even an architect, though I must tell you that architects' furniture is not generally successful. Possibly, if you are known to any first-class cabinet maker, you might arrange with him to supply you with a design, but you will probably have to pay less if you apply direct to the artist. If you do not know any, we can give you the name of one who might be willing to undertake the commission.—D. D.

Lapidary Work.—The best book I know of is Holtzappfel's "Turning and Mechanical Manipulation." Vol. III., Section II., is "A Descriptive Catalogue of the Apparatus, Materials, and Processes for Grinding and Polishing Commonly Employed in the Useful Arts." That volume will answer, I think, all your questions. If it does not, write again, but limit and define your wishes, for the means taken to produce fine-cutting edges will vary according to the shape and the use to which the tool is to be put. And the same remark applies to the other six questions you ask or imply in your letter. As the work mentioned is a very valuable work for reference, and is also very expensive, you might apply at your public library, and, if it is not there, make an application to have it added. It is published by Holtzappfel, Charing Cross, London, and altogether consists of five volumes. A cheap book from which you may get some good hints is "The Mechanic's Workshop Handybook," Hasluck, published at 2s. by Crosby Lockwood & Co. In this, Chapter VII. on "Tool Grinding," and Chapter IX. on "Abrasive and Finishing Processes," particularly apply to your inquiries. By-the-bye, have you not to some extent tried to mislead us by defining your queries as "lapidary's" work? Should it not be instrument maker's or cutler's work?—H. S. G.

Lathe Dimensions.—G. H. R. (*Saltley*).—If I were you I would buy the castings of your proposed headstock and work to them. Remarking upon your drawing, you have only ½ in. of metal round the gun-metal bushes of mandrel; you would burst your casting by driving in the bushes. Have 1¼ in. there. There is only $\frac{1}{16}$ in. allowed between the front of headstock and back of collar on mandrel head; why, the mandrel will wear back till collar touches headstock in a year or so, and then where will you be? I would allow at least ½ in. between collar and front of headstock. You show in your drawing below the base of headstock 8 in. wide; I think 6 in. is plenty. It need not be wider than the poppet, and that must pass between the wings of the saddle. Now, as to the way the mandrel is made, with two conical bearings pointing the same way: I know Whitworth has made lathes that way, but then he uses hard steel, and the wear is practically nothing. I don't approve of this plan, because you cannot be sure the two cones will wear equally, and there is no means of adjusting one without the other. Suppose the front cone wore in $\frac{1}{16}$ in. the first year, and the back cone not at all (a very likely thing), then you could not take up the wear. No, no! Stick to the usual plan; fit a loose cone on the back end of mandrel, and turn it the opposite way. Size of your front cone will do; body of mandrel on which loose pulley turns may be reduced 1¾ in.; then reduce again to 1¼ in. where the sliding cone fits on with a feather. Not having myself an 8 in. back-geared lathe, I applied to some well-known makers (the Britannia Co.), and they have kindly sent me a tracing of the back-gear spindle of 8 in. lathe. You will get from this the width of wheels, which will enable you to determine the length of your headstock; wheels are 6·16 in. apart from centre to centre, 48 and 14 teeth, $\frac{5}{32}$ circumferential pitch, and 5·03 diametral pitch.—F. A. M.

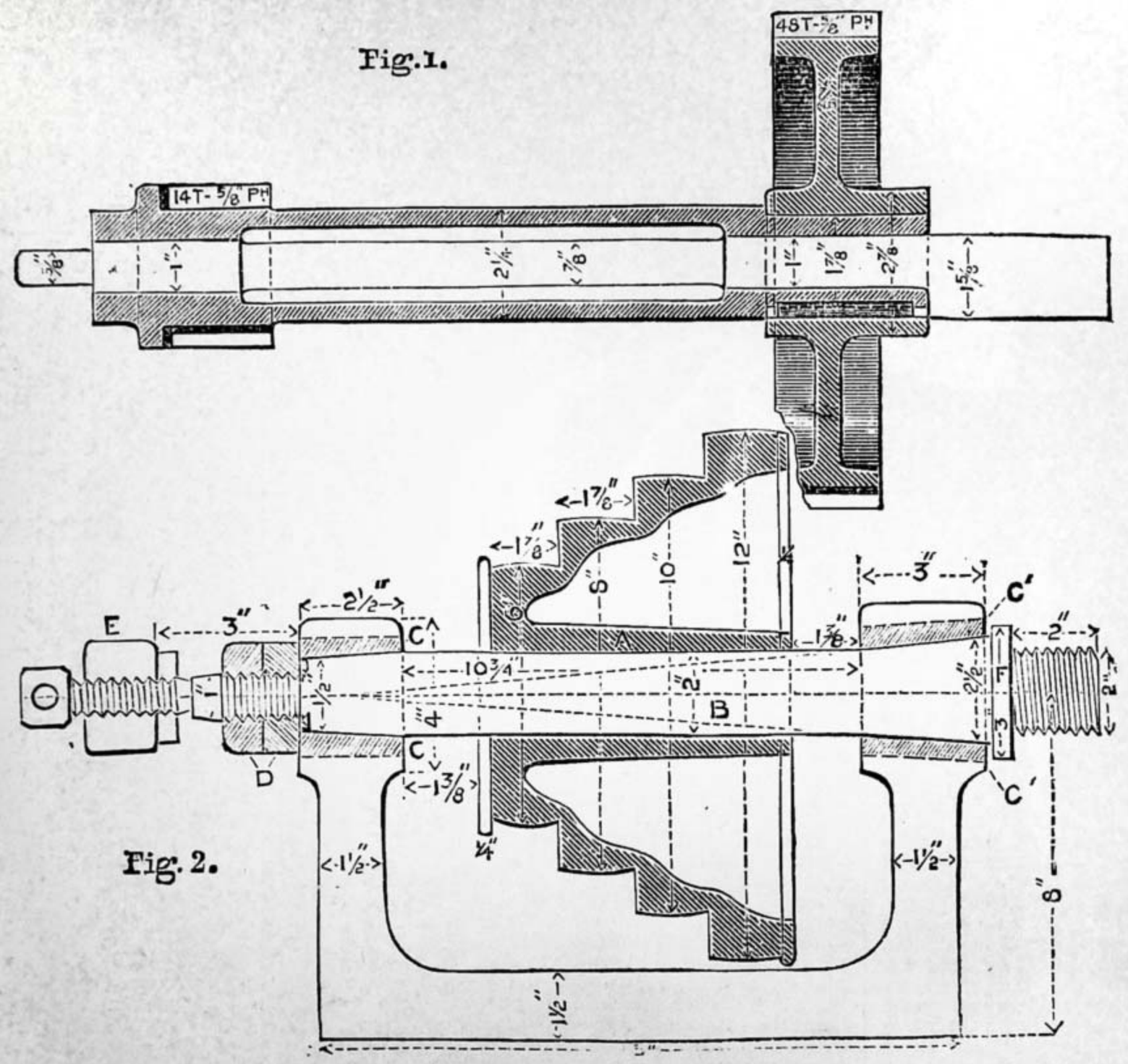

Fig. 1.

Fig. 2.

Fig. 1.—Section of Back-Gear Spindle of 8 in. Lathe. Fig. 2.—Design for 8 in. Headstock. A, Pulley Boss; B, Mandrel; C, C, Collar; D, Lock Nuts; E, Thrust Pin.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Nitric Acid Guard.—ACID writes:—"Will you or some of your correspondents kindly give me an answer to the following? I have six earthenware trays, in continual motion, containing a strong solution of nitric acid and water. There is great splashing; to catch this I have lined the floor with a tray 14 ft. by 10 ft. with 10 lb. lead. The solution, I find, eats the lead away; I have tried pitch, cement, but nothing seems to stand. I must make it perfectly watertight, as there is valuable machinery underneath. I may add there is a vibration of the floor upon which the tray is fixed. And I must also provide for a waste-pipe, as there is a continual flow of water solution. Can any of your readers assist me?"

Brazing Band Saws.—S. B. (*Nottingham*) writes:—"Having bought one of Duncan & Mills' patent brazing machines second-hand, I should be much obliged if some reader of WORK would give me instructions how to use it."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Pocket Lamp.—THOMASO writes in reply to W. G. H. (*St. Germans*) (see page 191, Vol. II.):—"I saw the lamp referred to exhibited in the shop windows of several tobacconists in London some two or three years ago; but I have not noticed it lately. It can scarcely be called a lamp, as striking the percussion cap merely caused the cotton wick to smoulder, sufficient to light a pipe or cigar; no oil or spirit was used. I expect it has gone the way of many another invention for the same purpose—beaten out of the market by the simple lucifer."

Pocket Lamp.—D. M. J. (*Portsmouth*) writes in reply to inquiry by W. G. H. (*St. Germans*) (see page 191, Vol. II.):—"I have not heard of a pocket lamp to light with a percussion cap, and I do not think it would light a wick lamp. There was made some twelve years ago a gas burner ignited in a similar way, but was never used very much, except as a toy. The act of turning on the gas uncoiled a series of percussion caps on a roll of paper, and at the same time lifted a trigger, which was released and fell when gas tap reached full on, and striking the percussion cap lit the gas already coming from the burner. The slightest damp caused a miss fire, and nothing can beat a simple match."

V.—ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—E. D. B. (*Stoke Newington*); IAGO; JOINER; T. D. (*Bury*); A. E. P. (*Dalston*); A. E. R. (*Kingston*); A. W. S. (*Enfield*); A. R. B. (*Totnes*); J. C. B. (*Sunderland*); J. M. C. (*East Greenwich*); NUB THUN; AQUA; H. W. T. (*Birmingham*); F. E. S. (*London, S.W.*); A SUBSCRIBER; S. W. (*Camberwell*); J. S. (*Kirkcaldy*); A TINSMITH; W. J. B. (*Sidbury*); J. T. (*Cheshire*); W. BROTHERS (*Hereford*); F. S. M. (*Portland, Maine*); P. H. (*Bristol*); A F. R. (*Birmingham*); E. W. S. (*Eastbourne*); BETA; H. S. G (*Battersea*); A. G. H. (*Bradford*); E. D. B. (*Stoke Newington*); G. H. B. (*London, W.C.*); C. H. G. (*West Ham*); J. D. (*Manchester*); R. A. (*Birkenhead*); F. S. (*Exeter*); R. H. (*Glasgow*); J. R. (*Alyth*); T. F. (*Leeds*); W. B. (*Wigan*); C. M. (*Shrewsbury*); F. W. (*London, W.*); E. W. S. (*Eastbourne*); A. F. R. (*Birmingham*); P. H. K. (*Bristol*); W. J. B. (*Worcester*); A. T. (*Leeds*); J. S. (*Kirkcaldy*); S.W. (*London, S.E.*); F. E. S. (*London, S.W.*); M. H. S. (*Birmingham*); C. B. (*London*); J. B. (*Sheffield*); J. M. E. (*East Greenwich*); A. E. R. (*Kingston*); A. E. R. (*London, N.E.*); T. D. (*Bury*); A SUBSCRIBER; IAGO; JOINER; H. D. H. (*Clevedon*); F. O. F. (*Hammersmith, W.*); T. J. B. (*Shrewsbury*); ONYX; S. E. R. (*Rye*); G. H. A. (*Sheffield*); MARBLE JOINT; E. H. (*Hampstead*); J. P. (*Glasgow*); POGLI; COQULICOT; INQUIRER; PUMP; E. G. F. (*London, W.*); A. T. & CO. (*London, E.C.*); W. G. G. (*Boro, S.E.*); W. C. (*Pewsey, Wilts*); S. H. C. (*Penzance*); A. R. S. (*Grays*); F. C. (*Cardiff*); E. L. R. (*Oxford*).

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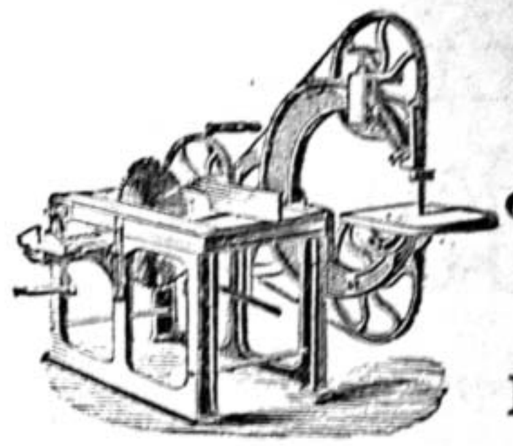

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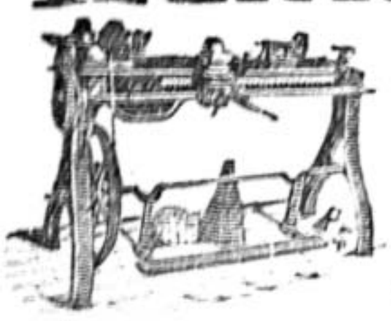

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